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ORGANIZED SPORTSMEN OF CALIFORNIA
GEORGE D. DIFANI
LEGISLATIVE REPRESENTATIVE

Joint Meeting of

SENATE INTERIM COMMITTEE ON PUBLIC LANDS

and

ASSEMBLY SUBCOMMITTEE ON PUBLIC LANDS, GRAZING & FOREST PRACTICES

of the California State Legislature

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PART II

Transcript of Afternoon Session

May 17, 1952

[Transcript of]

JOINT MEETING

of the

Senate Interim Committee on Public Lands

with the

Assembly Subcommittee on Public Lands, Grazing & Forest Practices
of the Committee on Agriculture

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PART II

1:45 p.m., May 17, 1952; Room 4202, State Capitol
Sacramento, California

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Assemblyman Lloyd W. Lowrey, PRESIDING, Chairman,
Assembly Subcommittee

I N D E X

Saturday Afternoon, 1:45 p.m., May 17, 1952

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AFTERNOON SESSION, 1:45 P.M., SATURDAY, MAY 17, 1952

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CHAIRMAN LOWREY: The hour of 1:45 having arrived and passed, I think we'd better get back to work.

Is Mr. Burrows -- Mr. Al Burrows here? I think perhaps we could well start the afternoon as long as we heard from the U. S. Bureau of Land Management this morning, perhaps we might as well hear from the U. S. Bureau of Reclamation. I have a communication from Mr. Dickinson. I might read this last paragraph: "Mr. Burrows does not contemplate making any formal presentation since, as I told you, we rely in general on other federal and state agencies for management and administration of watershed areas. Mr. Burrows is qualified, however, to answer questions on our operations and discuss our interest in the general subject of your conference."

It does happen that some misunderstandings or questions of policy have come up regarding the construction of stock watering dams, wells, drilling of wells, pumping, particularly in the Stonyford Drainage area above the Orland project. This question was referred to our committee sometime ago, and I discussed this with Mr. Dickinson, also with the Chico office, and it seemed the misunderstanding perhaps could be ironed out here in the public hearing where we could put the information on the public record so that we would all be better informed and eliminate that misunderstanding. If you could give us a general statement, Mr. Burrows, as to the policy of the Bureau as far as the management of wild lands are concerned, then perhaps we could spend a few minutes or as much time as necessary on this other question that has arisen because it does affect the management of our range lands inasmuch as you have to have water if you are going to run your livestock on the various areas.

MR. BURROWS: I am Al J. Burrows of the Bureau of Reclamation. I think I might make my initial remarks regarding the ~~patterns of the~~ lands which the Bureau of Reclamation has which might be termed wild lands. As you know, we have in the case of our operating projects certain peripheral lands around the reservoirs which, in the majority of instances, make a pattern of land that is conducive to a management program. Then, in addition to those lands, we have certain other lands scattered at random throughout the Sierra and Sierra foothill areas that have been withdrawn under the authorization of the reclamation law which states that when a project is under consideration, land shall be withdrawn in the interest of protecting the public interest at large while the feasibility of that project is being studied.

Now, those lands of that nature are largely what you might term a buckshot pattern. There are 40s, 60s, full sections, lands of that nature that do not form contiguous blocks. In those instances, our land management is largely conducted for us under agreement with the Bureau of Land Management whereby we deliver those lands which are under first form reclamation withdrawal to the Bureau of Land Management for leasing under Section 15 of the Taylor Grazing Act. In other instances, many of our lands which

are withdrawn under the first form are inside the boundaries of National Forests, and as such, come under the administration of the Forest Service, hence, under their land management program. We assume no responsibilities for administration of any of that nature, although we do cooperate with the Forest Service to the fullest extent.

There are a few areas where the Bureau itself administers the land, and I might add, in several of those instances, the Orland project being one of them -- the lands around East Park and Stonyford reservoir, and we have been in the past and we intend to continue to make every effort to interest some other public agency whose essential business is land management of wild lands in the administration of those areas under cooperative agreement.

There's another public agency that is not represented here today that similarly manages some of our wild lands -- that is the National Park Service at Millerton Lake and the San Joaquin Valley foothills. The National Park Service administers those lands similarly under cooperative agreement.

In all cases, we recognize the policy of multiple use as has been expressed before in the hearings today, keeping in mind at all times that the lands adjacent to irrigation reservoirs are primarily watershed lands. That does not mean that we exclude grazing or that we exclude timber production if that happens to be a use that is compatible with the protection of the reservoir. Protection of the reservoir and the watershed comes first as far as we are concerned.

Beyond that, I think in all our reservoir areas we have grazing leases for grazing permits that are administered under the established land management programs either by the U. S. Forest Service in the case of Shasta Lake, the Park Service at Millerton, the Bureau of Reclamation on the Orland project, and also coming back again to the Forest Service, the Clear Lake reservoir on the Klamath project. In addition to that, as I pointed out before, there are the Bureau of Land Management administrative areas.

I think that, in general, gives a very brief idea of how we go into this land management. We also, incidentally, in setting up grazing areas or timber areas as a primary use, make no specific effort to derive that information ourselves. That's something that many of these state and federal agencies that are represented here today have gone to quite a bit of effort and expense to make those preliminary surveys and studies. Wherever at all possible, we draw on that information, then utilize our own field forces to fill in the gaps that are necessary to come up with any sort of an interpretation of the highest and best use and formulate a policy of management pointing some specific agency or our own as the case may be. Does that answer your --

CHAIRMAN LOWREY: I think that's very commendable because there are many who feel that we have too much duplication in our programs of the better management of our wild lands and I believe the committee is very happy to know that your agency is using the facilities of existing agencies so you won't have to duplicate work that is being done or has already been done.

Now, I think we have someone here in the audience -- oh, yes, here he is. Please identify yourself and speak directly into the microphone.

MR. MORRIS: My name is Sheldon Morris. I am representing the Colusa County Farm Bureau. I have a statement that I want to make concerning this stock water dam problem.

This meeting was called primarily to consider range and grazing. It seems to me that stock water dams are a very important part of that matter. We've had a little difficulty in the western part of Colusa County in the Stony Creek watershed in getting permission from the Bureau of Reclamation to put in stock water dams. This has come to my attention through the PMA Committee in Colusa of which I am a member. I know that these exist there; the farmers are having trouble; I know some that are afraid to go ahead and put in a dam because of the expense and the possibility that they won't be able to use it after it is constructed. They have no water rights; however, they own the land, and it is the contention of the Colusa County Farm Bureau that these people should be allowed to put in that dam without permission from the Bureau of Reclamation. It holds such a small amount of water that it wouldn't make any difference in their stream flow, and still we've had considerable trouble in getting permission to get these through. I'd like to ask the gentleman if there is any way possible that these can be put through in such a way that they are not required to have permission of the Reclamation Bureau.

CHAIRMAN LOWREY: Mr. Burrows, could you answer that question for them?

MR. BURROWS: No, sir, directly, I couldn't answer those questions. From my own particular viewpoint, I would have to refer to the fact that the Stony Creek as you are acquainted is an adjudicated stream and the Bureau, in our operations up there to the best of my understanding, operate within the terms of the adjudication, and any new water uses or any modifications in the water use on that stream, it has always been my understanding, is something that must be cleared with the Federal Watermaster and be cleared in accordance with the adjudication.

Now, beyond that, I wouldn't feel qualified to make any comment because, in the first place, I'm not an expert in water rights, and I'm not familiar with the adjudication other than the fact that it does set down certain stipulations regarding water as it is connected as a right with certain lands in the Stony Creek watershed.

My principal experience in that area has been in connection with the management of the lands immediately surrounding East Park and Stony Gorge reservoirs where the problem of water development has not, as you can readily recognize, been one of our problems because in no case do those lands extend very far back from the water surface. In handling stock management up there, there has been no need for stock water developments on those particular reservoirs. Consequently, we've had from the land use standpoint which

I represent -- the land use office of the Bureau of Reclamation -- we've not had occasion to come up against that problem. I do know that the problem has been referred to the regional office as a result of contacts that have been made with the Chico office, but beyond that I wouldn't feel qualified to make any statements because I'm not familiar with the situation at hand.

CHAIRMAN LOWREY: Well, you weren't advised by or authorized by the Bureau apparently then to give us definite information on this particular subject.

MR. BURROWS: No, sir, because I don't believe at the present time it is available because the impounding of water in any way outside the adjudication is something that I'm not familiar with.

CHAIRMAN LOWREY: Well, are you familiar with -- suppose Party A owns 160 acres in that watershed; suppose he drills a well or wants to drill a well on his own private property; does he have to get permission from anyone in order to put that well down and then pump water from it?

MR. BURROWS: From my own personal experience, I would rather question that he would. However, from a legal standpoint, I'd feel that I would have to refer that question to someone more thoroughly versed in water rights than I am. I'm sorry, sir, but --

CHAIRMAN LOWREY: Has the Bureau taken a position on that particular problem or not?

MR. BURROWS: No, sir, but I'd be glad to refer your question to our regional counsel.

CHAIRMAN LOWREY: I wish you would because I've already discussed this over the 'phone and personally with Mr. Jones. I mentioned it to Mr. Dickinson and I told him this subject was going to be up for question. It was my understanding that you would be given authority and come prepared to properly answer these questions. I know they're rather technical, but we're very much concerned. We want this problem definitely ironed out because I feel sure you can see that it may affect our thinking as far as various projects are concerned in the State of California not only in that particular area but in other parts of the State.

MR. BURROWS: I can readily see your concern. Mainly looking at it from the standpoint of land management phase where you are dealing with livestock, water is a necessity, but from the standpoint of the legality of it, sir, I don't feel qualified to answer that and I have not been advised.

CHAIRMAN LOWREY: Mr. Morris, do you have any other questions?

MR. MORRIS: I think he's right as far as the technical questions are concerned, but we were of the opinion that something could be done to change it, if it had to go back to Washington, so that these things -- a small amount of water for stock water, probably wouldn't be over 8 or 10 of them in that District, could be built without interfering in any way with their flow of water only on

a very dry year. It seems rather absurd that we have to get permission from the Bureau of Reclamation to put in a small dam like that to water stock which is a necessity to any stock man.

CHAIRMAN LOWREY: Now, that's on your own private property?

MR. MORRIS: It's not on my property, but on private property. The water runs through their land, and I would think that they would have first rights to a small amount to water their stock. That's the way we look at it from there, and we'd like to have something done on it if possible or any answer of some kind if we could get it now or in the future.

CHAIRMAN LOWREY: Well, Mr. Burrows, do you think that you could carry this message back to the proper Bureau officials and perhaps arrive at some answer? Could you inform us as to what your policy is or as to how we should proceed further on the subject?

MR. BURROWS: I'll be glad to relay your request to Mr. Boke and the regional counsel, and I'm sure they will communicate with you.

CHAIRMAN LOWREY: Now, is there anyone in the audience that cares to ask a question on this subject or has a comment to make?

This is Mr. Garland from Stonyford. Would you identify yourself and give us the benefit of your thinking on this.

MR. GARLAND: I am G. A. Garland of Stonyford, the Federal Watermaster for the adjudicated rights on the Stony Creek watershed.

To fairly understand the situation, I think you should all understand that the corpus of the water remains in the ownership of the State -- the State owns all water. It is never owned by an individual whether it is an underground stream, in a well, or in a running stream on the surface. An underground stream is just as much the augmentation of a stream flowing on the surface as if that water was flowing on the surface providing you can prove that that water reaches a beneficial point where it can be used. The water in a well is owned by the State and the only reason I can't go on your property and use your water in your well is you won't let me trespass upon your property. But the water itself is owned by the State. It's just the same as deer. Right this minute, he's on my property; tomorrow he's on your property. You can't say that that deer is the man's property when it is on your property. It's State property because he's going. The water underground is moving all the time, and today it's on my property and tomorrow it's on yours.

The waters of the Stony Creek belongs to the State and it has been adjudicated, and when it falls, you haven't any right to store it for any reason. There is salvage water at all times. This surplus is unappropriated waters, but I can't see how any farmer or anybody who's got a piece of ground anyplace can go to work and put in a dam and store State water without the knowledge and permission of the State because somebody else will want the use eventually of some of that water and the State will grant him

permission to use the water in that particular ravine and yet he may be interfering with somebody else, a prior user which has a prior right.

Now, you take the Orland project. They have a certain priority, and those who have a prior right to the Orland project, they have a right to come first; those that are subsequent come later. If you're going to have everybody building dams promiscuously without any knowledge, you are going to get the whole State Water Resources Board balled up. They won't know where they're at. I'll admit that it is a hardship on the farmer who has a range and good range perhaps back in the hills which is dry. He can drive his cattle back to the range and they'll stay there until they get thirsty. Then they'll come down to where there is water and there they stay. They won't go back. Whereas, if they can have the water dam back in there, they'll go back and utilize that range and it is very beneficial.

Some years there wouldn't be any damage. Now this past year, you could store water and damage nobody, but the short water year, you can't and you don't know when there is going to be a short water year until the rains are over with. It's quite a problem.

I appreciate thoroughly and am in sympathy with the cattle raisers. They need those water dams and when there is salvage water or surplus water, I think there ought to be some way of utilizing that water, and I don't like the way the Bureau of Reclamation do because anybody that is in their area, they just protest on general principles. They've got attorneys, and anything in their area, they just protest it. Well, then the cattle raiser has got to go and hire attorneys, and the first thing you know, their water is costing more than the water is worth. I don't know what the answer is, but there should be some way of utilizing the surplus water in a wet water year than at the present, but I don't know what the answer is.

MR. MORRIS: Mr. Garland, I agree with you as far as storing all the water of a certain creek, canyon or something of that sort. I don't think that should be done. If you are taking just a small part of it and letting the biggest part go by, I don't see where you've done any damage. On a dry year if you had your stock water dam full, the farmer could release it and let it go on down in a dry year.

MR. GARLAND: Yes, but when he does that he's got a dry creek bed for say five miles. He can turn it loose but there probably wouldn't be a bucketful get down to the stream where it would do anybody any good, whereas if he would let it go down in the wintertime when the ground was soaked, it will all get to a point where it could be beneficially used. It wouldn't do any good. He'd turn out a reservoir maybe 25 or 50 acre feet, turn out 5 foot a second, and by the time it got the ditch soaked up between there and someplace where the ground is wet, it's all soaked up -- it's all gone by evaporation, percolation, and just soaking up the ground.

MR. MORRIS: The reservoirs I'm speaking about hold from 6 to 12 acre feet. There are none of them any bigger than that that I know of. They're not for irrigation -- strictly water for cattle.

MR. GARLAND: That would never get to a point, and two or three or a few of those reservoirs would make no difference; but if you put in four or five hundred of them, you've got quite an amount of water.

MR. MORRIS: That's right, but our contention on this in Colusa County is that there will be such a small amount of them that you'll never know.

MR. GARLAND: I think that there should be a record made of all reservoirs in the State so that they know where they are. Somebody makes application for the unappropriated water of some ravine and come to find out there are several reservoirs there that they didn't know anything about. We should have a record of them, but they shouldn't cost them the price that it costs them now to get it.

SENATOR SUTTON: Mr. Garland, the only purpose of this committee meeting is to recommend legislation to the legislature or amendments to legislation, and I take it that you think a different approach should be made towards this matter.

MR. GARLAND: Very definitely. There should be some approach made so the waters could be utilized to benefit, and in a year like this when there is plenty of water, they should be permitted to store that surplus water.

SENATOR SUTTON: As a matter of background, when Senator Crittenden was bringing on his only bill he ever had that is know by number -- 677 -- the Water Resources bill, Senator Mayo introduced an amendment to it that 15% of the water in the mountain area of origin would be retained and held if and when that area would ever want to use it. That amendment I went over to and supported, but if it had gone through, it would have killed the bill so it was stricken out to save the Water Resources bill. What do you think of such an approach as that?

I don't know whether that could be retroactive, but a certain percentage is reserved for the back countries. The valleys are not to be permitted to strip the back countries of drinking water.

MR. GARLAND: Well, that might be all right, but it wouldn't apply to the Stony Creek watershed. That has been adjudicated by the Federal Court and I don't see how it --

SENATOR SUTTON: If this was established in the future perhaps by negotiation, we could shame them into granting.

CHAIRMAN LOWREY: Mr. Garland, did you say that the difficulty arises because the Bureau protests the construction of these dams by the local farmers?

MR. GARLAND: As far as I know, they haven't protested but a few of them because they get built. They just build them and nobody knows anything about them. I'm confident that if these stock water dams -- if you applied to the State Water Resources Board for permission to construct a dam and retain water within the watershed at Stony Creek, there would be an immediate protest by the Bureau of Reclamation on general principles. That has been the policy in the past. One I know of who thought he'd go about it in the legal way made an application for a stock water dam and immediately there was a protest from the Bureau of Reclamation and he didn't go through with it, but right along side of him, they build stock water dams because nobody knows anything about it. They just go out and hire a bulldozer and a carryall and they build a dam, and you wake up the next morning and there's a dam. The rains come and the dam is full, and the first time you know the dam is there is when it rains, and you go by the road there and lo and behold, you've a lake out in there and you didn't know anything about it.

Well, now the fellow that wanted to go the right way, his lake is dry because he couldn't build it and some others who didn't say anything about it, they've got the dam but there is no record of it. The only way I know about it is when I happen to see them. I'm never notified and I don't know but I doubt very much if the Water Resources Board -- they would not permit them of getting a right to the unappropriated water or the salvage water of the stream. They just get it.

SENATOR SUTTON: Following the same line of thought, you think the legal procedure would be to request that you could put a domestic well down for drinking water in that area?

MR. GARLAND: Well, as I understand the law in that is this, you may not use any water going to or coming from a stream that is adjudicated. It is as much a part of the stream -- a surface flowing stream -- as the stream itself. However, if you go down and dig a well in the creek bed, it is not very difficult to prove where the water is coming from. If you go back a mile, it becomes more expensive and the farther back you go, why the more expensive it is, but it all can be proven where the water is coming from and where it is going - if it is of sufficient interest to prove it. Of course, they oftentimes when they put in the well and pump from it and it is an adjudicated area, they maintain they are pumping from an underground reservoir that has no connection with the stream, and then it is up to the one who is interested to prove differently. You get a well that is several miles away, it is an expensive proposition to prove where it's coming from or where it's going, but the water in the well is just as much State water as the water flowing in the creek.

CHAIRMAN LOWREY: Thank you, Mr. Garland.

Now, on behalf of the committee, I'm going to ask Mr. Murphy from the Legislative Counsel if he will investigate this matter for us and get the legal facts. I'd like to also ask the Bureau if they would cooperate with the Legislative Counsel in

opening your files and giving them the information and assistance that might be necessary in going into this matter in a proper legal manner. I assume that we can anticipate that cooperation, is that not true?

MR. BURROWS: I can see no reason why you can't, and I'll pass your request along.

CHAIRMAN LOWREY: Thank you, and you might also pass the information along that we would appreciate full cooperation on this because I took it up as I want to reiterate, I couldn't talk with Mr. Boke, but I did talk with Mr. Dickinson and I told him very definitely this proposition was coming up. I know Mr. Jones would have been more than happy to be present and to cooperate fully with us. Now, we do hope that we will get cooperation on this, and I'm going to entertain a motion that this matter be referred to the Water Committee because we certainly don't want to exercise any of the prerogatives of our Joint Committee on Water. Do I hear a motion that we ask Senator Williams' committee to make a further investigation of this proposition? I think it's worthy of further investigation.

ASSEMBLYMAN LINDSAY: I so move.

SENATOR JOHNSON: I second the motion.

CHAIRMAN LOWREY: It has been moved and seconded that we ask the Joint Interim Committee on Water Problems to make a further investigation of this water problem regarding stock dams and wells in the Stony Creek Drainage.

MR. BURROWS: I think, sir, if I might add, you'll find that we are willing to cooperate. As Mr. Garland pointed out, our primary interest is in the dry years in maintaining a sufficient water supply for the Orland project, and we're responsible to the Orland project water users' association. As Mr. Garland pointed out, in wet years there is a surplus of water there and people can use it, but it's the dry years that we are primarily concerned with. If something like this could develop on an extensive basis, it could be a rather serious thing in the dry years, so I'm sure you'll find that we are willing to cooperate with you in your investigation.

CHAIRMAN LOWREY: Thank you very much. Are there any other questions or comments on this particular phase?

Professor Madson was unable to be here today. Is there anyone from the Range Advisory Board that would want to offer any testimony or make any comments? I know we have members of the Advisory Board here.

If not, I'd like to call Mr. Frederick Meyer from the Division of Beaches and Parks and desire to have entered in the record a letter addressed to me as chairman of the committee from Mr. Newton B. Drury acknowledging receipt of the invitation to appear saying that they would have a representative present. (See Exhibit #1 attached.) Following that, I contacted him by

'phone and on April 15, I have another communication I'd like to put in the record in which he mentions, "I'm having a representative of our Division to be present as an observer". (See Exhibit #2 attached.) Following receipt of that letter, or I believe the same day, I again contacted Mr. Drury by 'phone and advised him that we would be very happy to have an observer, but wanted someone here that could speak for the Division of Beaches and Parks with authority on policy and all phases of their program. I'd like also to have this entered in the record. In addition, we have a letter from General Hannum which I believe will speak for itself. It wasn't exactly what we wanted, but at least it indicates that Mr. Meyer has a certain amount of authority at least to speak for the Division of Beaches and Parks.

Because of the way that this has developed, it may be necessary in the not too far distant future to call another hearing and at that time, I hope, Mr. Meyer, that you will relay the word to your Chief and to the Commission that we will expect them to be present. We intend that they shall be present! I hope you will tell them that that is our feeling. I'm sorry to put you in that unfortunate situation, but we want the record clear and we hope that in the future we will have much closer cooperation.

MR. MEYER: I'll be glad to relay your message, Mr. Lowrey.

CHAIRMAN LOWREY: We'll also put it in writing for them.

MR. MEYER: On behalf of Mr. Drury, I want to say that the State Park Commission is having their meeting in San Diego. The formal meeting was held yesterday and they also had scheduled a series of inspection trips which will run into today and perhaps tomorrow, also, in the southern part of the State. I'll do the best I can to pinch hit for Mr. Drury in giving you the picture of grazing in the California State Parks which is a very small business compared to the activities of most of the other agencies at this hearing.

As of January 1, 1952, the State Park System was composed of 117 parks, beaches, and historical monuments, embracing a total area of 584,416 acres, which is slightly less than 0.6% of the area of the State of California. Of this total park area, some 79% - or practically 4/5ths - is accounted for by two parks in the Colorado Desert, namely Anza Desert and Borrego State Parks, located in eastern San Diego and western Imperial Counties. These two large desert parks embracing 461,137 acres of State Park Land are in a class by themselves in several respects and it is helpful to separate them from the rest of the parks in presenting statistical data. The remaining 115 units of the State Park System cover 123,279 acres, or slightly over 0.1% of the total area of the State.

As of April 1, 1952, the Division of Beaches and Parks had 14 grazing permits in effect, involving 8 state parks. Of the 14 permits, 8 of them were issued for various portions of Anza Desert and Borrego State Parks. The 8 permits in these 2 desert parks involve 63,483 acres, or about 14% of the total area of these two parks. In contrast, the 6 remaining permits in the other 115 units of the state park system involve a total of only 2103 acres, or only 1.7% of the acreage embraced in the parks outside the desert, and only 0.36% of the total area of the state park system. In addition,

the re-issuance of a grazing permit for Cuyamaca Rancho State Park is being considered by the Park Commission at their meeting this weekend. This is a larger area involving some 19,000 acres.

The total annual income to the State from these grazing permits amount to $5,430.70. If the permit at Cuyamaca Rancho State Park is approved, it will probably raise this amount by some $15,000, judging by the fee received from the previous permit in that area.

As was indicated in General Hannum's remarks, read by Mr. Nelson at the opening of this hearing, grazing permits in the two desert parks were issued because the land is unfenced, and there is no practicable way of keeping livestock off park lands which adjoin or are intermingled with private lands, since the cost of fencing would greatly exceed the value of the sparse desert range. In the other parks, grazing came about mostly as a hold-over from conditions existing before the state acquired the areas. In some cases, the continuance of grazing was specified in the conditions under which the parks were acquired.

As you know, the various units of the State Park System are established either to protect and make accessible areas of outstanding scenic or historic interest, or to provide park-type recreational facilities in areas where such facilities are needed. It is the duty of the State Park Commission to give first consideration at all times to the use and enjoyment of park area by the public in connection with all activities and developments in the parks. All permits and concessions must be justified as being for the benefit of the park. Grazing permits usually contain a justification clause to the effect that the fire hazard will be reduced through decreasing the volume of grass and other inflammable material.

The Division of Beaches and Parks not infrequently receives complaints from the public regarding annoyance by livestock, in those parks where grazing is now permitted. Grazing in some park units has been terminated by the State Park Commission upon determination that it either was no longer of benefit to the park or that it interfered with the recreational use of the parks by the public.

ASSEMBLYMAN BELOTTI: Do you know whether or not the grazing permits have been terminated in the area up there in Del Norte and Humboldt?

MR. MEYER: There is still a grazing permit for Del Norte Coast Redwood State Park and the understanding that the Commission had with the permittee was that there would be an investigation made during the current year whether it would be continued beyond the current year or not.

SENATOR JOHNSON: Do you know if there is a permit on Donner Memorial State Park?

MR. MEYER: No, there is not.

SENATOR JOHNSON: Do you people object to the former stock owner there grazing sheep on the portion of the park that you do not use? Are you familiar with the protest of the former grazer in there?

MR. MEYER: No, I'm not familiar with anything concerning former grazing in the area. If the former grazer wanted to graze in the park, the proper procedure would be to make formal application to the Park Commission and they would consider his request and make the investigation and act accordingly.

CHAIRMAN LOWREY: Have you had any requests for grazing on any part of Diablo Park?

MR. MEYER: Grazing was formerly permitted on Mt. Diablo State Park, and it was terminated two or three years ago. It was sheep grazing, and it was terminated because it was felt that it was no longer necessary for the protection of the park and that there was interference with the recreational use of the area.

CHAIRMAN LOWREY: That the sheep were interfering with the recreational area? Now, is the southern part of that park used extensively for recreation?

MR. MEYER: I have no personal familiarity with the immediate area that was included in the grazing permit.

CHAIRMAN LOWREY: Well, is there any part of the park area that isn't extensively used for recreation?

MR. MEYER: Only the fringes, I would say. There are two approach roads, as you know, from the northwest and from the south and there are recreational developments along both those roads, particularly the southerly road that goes through Rock City.

CHAIRMAN LOWREY: Well, what was the determination based upon that there was interference with the recreational activities by the grazing of the sheep?

MR. MEYER: That investigation was made, I believe, by the District Park Superintendent in San Francisco and I'm sorry, but I'm not personally familiar with that.

CHAIRMAN LOWREY: You don't know what the basis for the refusal to grant the permit was?

MR. MEYER: The correspondence on it said that it was interfering with the recreational use of the park and that is all that I really know about it.

CHAIRMAN LOWREY: Well, you are the forest technician in this phase of the park -- or am I mistaken on that?

MR. MEYER: Yes, I have been active in this phase of it only for a few months. I did not make that investigation. I did not work on that subject at the time of the investigation.

CHAIRMAN LOWREY: Well, now, have you had any requests from Marin County for grazing permits.

MR. MEYER: We have a grazing permit in Samuel P. Taylor Park in Marin County. It is in existence at the present time.

CHAIRMAN LOWREY: Do you know if it is contemplated to deny that permit in the near future?

MR. MEYER: I have not heard of any such proposal.

CHAIRMAN LOWREY: The reason I ask these questions is that I have had innumerable questions posed to me up and down the State on grazing permits and those that happened to come to mind I have mentioned. I wonder if there is any comment from the audience regarding these permits.

Mr. Wing.

MR. WING: Mr. Chairman and members of the committee, my name is W. P. Wing, Secretary of the California Woolgrowers' Association. On or about January 25, Dr. H. H. Biswell, Land Specialist, School of Forestry, University of California, Berkeley, together with the District Ranger of the California Division of Beaches and Parks, and I visited the Mt. Diablo State Park which comprises some 2,000 acres. We asked Dr. Biswell who is a specialist in the field of grasses and who is working both with the Division of Fish and Game doing special work for it as well as his regular duties with the School of Forestry, University of California, to make an unbiased checkup on the question of grazing on the Mt. Diablo State Park. This is what he stated in a letter addressed to me dated January 31, 1952:

"This concerns controlled grazing of the Mt. Diablo State Park area.

"Of course, we must look upon this area as one purchased and managed primarily for recreation. Many people go there during the weekends for picnicking and camping. In spite of this, however, I would recommend that the area below Rocky Point be grazed moderately by domestic livestock, either sheep or cattle. The primary reason for grazing would be to reduce the fuel and fire hazard. In other words, the grazing could be looked upon as a tool to improve management for recreation. Without grazing the grass and weeds would continue to accumulate and a wild fire might then become so intense as to destroy the scattered oaks which add beauty and value to the landscape for campers. An intense wild fire might also endanger the lives of the campers, and would be a threat to the buildings around headquarters. The area will certainly burn sooner or later and some effort should be made to keep the fire hazard at a low point. The most practical way to do this is through moderate grazing. I would not recommend heavy grazing for fire hazard reduction even though this would reduce it more than moderate grazing.

"Above Rocky Point and toward Juniper Camp, the yield of forage is rather low and the grass seems to be fully utilized by deer. At least there is very little residue on the ground now, following a year when there was no domestic livestock grazing. Without means of controlling deer populations about the only way left to control utilization of forage on the range is through regulation of livestock grazing. I would recommend, however, that some means be worked out to control deer populations on the area also. This could probably

be done by arranging for a two or three day hunt in the middle of the week when campers could be kept off of the area.

"A good many ground squirrels live in certain spots, I see no particular recreation value in these and I would recommend that they be poisoned.

"I have been going through the park for the past three years and it was my opinion that the range was grazed too close (by sheep, deer and rodents combined) during the two years it was used by sheep. This was indicated by lack of residue on the ground and by the bare soil showing on certain slopes and points. I think that total use of forage should have been more on the moderate side.

"Moderate grazing in the areas of highest forage production will favor and help maintain desirable forage plants, such as bur clover and redstem filaree, and high grazing capacity. With too much protection the highest yielding areas will soon go to grass and thistle and the grazing value for both deer and livestock will decrease.

"I believe that the forage in the park could be better utilized by cattle than sheep. Cattle would tend to graze more in the areas of high forage production and would not graze the steep slopes and points as much as the sheep. Also more residue can be left on the ground for cattle than sheep since the cattle will eat dry grass along with the green in the fall and winter.

"It is my thought that neither sheep nor cattle should be looked upon as something to be frowned upon by campers. In fact, I believe that campers would rather enjoy observing either sheep or cattle in their grazing habits. A cattleman might not want his animals on the place, of course, because they would be disturbed to some extent by the campers.

"To summarize, I would recommend that the park area below Rocky Point be moderately grazed by domestic livestock, the chief advantage to the State being to reduce fire hazard but also to maintain better quality forage for deer. If sheep are used they should be herded away from points and gullies where forage production is low and the soil is apt to be kept bare by livestock activity.

"Sincerely yours, signed H. H. Biswell."

I might add, Mr. Chairman and members of the committee, that it seemed to us in questioning some of those who had to do with the management of the Park that apparently there is no cooperation whatsoever with either the California Department of Fish and Game or the California Division of Forestry, the latter agency which is charged with trying to avert fire disaster. We would think that if they worked out a cooperative program with the California Department of Fish and Game and the California Division of Forestry, they could work out a program which would be beneficial for the recreationists for which the area was originally established.

Thank you indeed.

SENATOR SUTTON: If I understand correctly, a statement was made there that where there is grazing, if inadequately grazed, it will eventually defeat the pasturage value to the harm of pasturage for sheep. It mentioned thistles.

MR. WING: That is correct.

SENATOR SUTTON: Could that be reread?

MR. WING: "Moderate grazing in the areas of highest forage production will favor and help maintain desirable forage plants, such as bur clover and redstem filaree, and high grazing capacity. With too much protection, the highest yielding areas will soon go to grass and thistle and the grazing value for both deer and livestock will decrease."

SENATOR SUTTON: That's an astonishing statement. Thank you.

CHAIRMAN LOWREY: Thank you, Mr. Wing.

Mr. Meyer, do you have any estimated population figures of wild life on the individual parks or total?

MR. MEYER: On wild life? I'm sorry. I don't have that information.

CHAIRMAN LOWREY: Have any such studies been made on your parks?

MR. MEYER: Not recently, I believe.

CHAIRMAN LOWREY: Are any contemplated?

MR. MEYER: None that I know of.

CHAIRMAN LOWREY: What is your policy regarding investigations for fire hazard and adequate forage for your wild life or do you have any policy in that respect?

MR. MEYER: As far as wild life is concerned, the State Park Commission has left it pretty much up to the Department of Fish and Game to take care of all the state-owned lands. They do not have any direct policy for wild life other than the fact that all wild life is protected in state parks. They are not game management areas in the strict sense of that term.

CHAIRMAN LOWREY: Well, then, do we understand by that that you have a cooperative arrangement with Fish and Game to come in and manage the wild life on your state parks? Is that the setup?

MR. MEYER: There is no formal agreement. What I meant was that the state parks function simply as game refuges. They are not game management areas, as such.

CHAIRMAN LOWREY: Then you feel that you need have no policy. For instance, it might be conceivable that you'd get such a tremendous population of wild life on your parks areas, at least it is conceivable to have such a tremendous population that disease would

enter the deer herd and you'd practically lose them all. Now, it's your policy not to take such factors as that into consideration?

MR. MEYER: It is conceivable that that could happen. I don't say that they don't need a policy, I say that I believe there is none -- not a definite one in that respect.

CHAIRMAN LOWREY: Do you have any gentlemen's agreement or working agreement of cooperation with the Division of Forestry on fire control or recommendations as to how best to provide for fire control on your parks?

MR. MEYER: I believe that there is legislation providing that the Division of Forestry protects the state parks from fires. However, in certain areas where state parks are within national forest lands, there is an agreement with the U. S. Forest Service to protect the park lands from fire.

CHAIRMAN LOWREY: Have you, in your knowledge, contemplated or have you ever used the research facilities of the University of California to get recommendations as to the proper management of your park areas in any phase whatsoever?

MR. MEYER: We have had correspondence with them and plan to undertake something along that line in connection with grazing, at least in certain areas. We have that in mind. We have no definite plans for it at any specific time, but we hope that some of that may be undertaken this year perhaps in the southern part of the state in the desert. There has also been some work done in connection with insect control in the timber areas and that is continuing, I believe.

CHAIRMAN LOWREY: I would like to ask your personal reaction to the letter which was read by Mr. Wing from Dr. Biswell. Inasmuch as you are a forest technician, it would be interesting to know your general reaction to this letter.

MR. MEYER: Well, Dr. Biswell's letter -- in addition to what is on the surface, it brings out many uncertainties in the relationship between grazing and fire and the relationship between grazing and recreation. I don't believe that the Park Commission, in taking the action that they did, was unaware of any of these relationships that were mentioned by Dr. Biswell. I belive that they simply acted in what they considered was the best interest of the recreation public -- the public using the park for recreational purposes.

CHAIRMAN LOWREY: Do they feel -- for instance, I noticed he mentioned the great numbers of ground squirrels. Now, does the Park Commission feel that that is in the interest of public health and the betterment of the State to have intense populations there not only for the potential disease factor that might develop but to spread them out over the adjoining areas? Or have they taken that into consideration?

MR. MEYER: I do not know whether they took that into consideration in this regard or not. There has been poisoning of ground squirrels in some of the State Parks. Whether it has ever been done at Mt. Diablo or not, I cannot say. I do not know.

CHAIRMAN LOWREY: Does that come under your prerogative as forest technician or is that part of your duties?

MR. MEYER: So far, I've never had anything to do with that.

CHAIRMAN LOWREY: Who in the Division of Beaches and Parks would have that directly under his administration? Is there a man assigned to that type of work, or do they just grow like Topsy?

MR. MEYER: No, I can't say that there would be anyone definitely assigned to take that. I think that would be handled by the administrative branch. In other words, by the District Park Superintendents. They would take action and make recommendations or else take direct action on the ground in connection with other state agencies. There are six administrative districts for the Beaches and Parks, each one under a District Superintendent and our administrative work is quite decentralized.

CHAIRMAN LOWREY: Any other questions?

ASSEMBLYMAN BELOTTI: I'd like to ask you, has the Division of Beaches and Parks done anything about the purchase of certain areas up there in Humboldt County to be set aside for recreational purposes -- say, for shooting grounds -- public shooting grounds for sportsmen? You know, there has been at least two sections up there that have been under consideration.

MR. MEYER: I doubt if that would come under the jurisdiction of the Division of Beaches and Parks. It probably would be Fish and Game.

ASSEMBLYMAN BELOTTI: I understood that the Division of Beaches and Parks had something to do with it.

MR. MEYER: I have not heard of it in our organization.

CHAIRMAN LOWREY: Thank you, Mr. Meyer, and I know that it must have been rather embarrassing for you to have these questions presented to you in this manner, but inasmuch as we were unable to get anyone else here, we had to ask someone. Again, I want to apologize for putting you in the position that we have, but we hope at the next meeting that there will be others in authority from your Division who will cooperate with us. Thank you very much.

We have several other papers here that I won't identify -- oh, perhaps I had better identify each one of them. There's a letter to Newton B. Drury from Frederick A. Meyer, subject Palomar Mountain State Park Grazing Study dated August 29, 1951 (see Exhibit #3 - 4 pages); a communication dated October 5, 1951, to Newton B. Drury from Frederick A. Meyer, subject Cuyamaca Rancho Grazing Conditions (see Exhibit #4); another one dated March 19, 1952, subject Cuyamaca Rancho Reforestation and Grazing to Newton B. Drury from Frederick A. Meyer (see Exhibit #5); a tabulation of three sheets dated April 1, 1952, on which are listed grazing concessions, revenue, the term, expiration date and the acreage (see Exhibit #6 - 3 pages). I'd like to have those entered in the record. Then another one -- a letter

from the California Woolgrowers Association, 151 Mission Street, San Francisco 5, to Mr. Newton B. Drury, dated March 8, 1952, and signed by Mr. W. P. Wing, Secretary (see Exhibit #7). Enter that.

I believe Mr. Schofield has something to say on this subject.

MR. SCHOFIELD: I am W. R. Schofield, California Forest Protective Association. I thought this committee in connection with the park inquiry might like to know what took place at the Park Commission meeting yesterday in which they had a very extended hearing in regards to grazing on the Cuyamaca. After both sides presenting the full detail, their support and opposition, the Park Commission ruled that they are going to permit grazing to continue on Cuyamaca under a plan of regulation which they have worked out. I think that is heartening to those of us who have had a little bit of altercation at times with the Park Commission relative to the complete locking up of park facilities. We feel in the lumber industry that they have treated very fairly what the legislature intended them to do in the way of access roads across state park lands, and we find no argument with them on that and now I think that the grazing people should take heart over the fact that the Park Commission did take the stand they did yesterday in regards to allowing the grazing to take place -- or to continue on Cuyamaca. I thought you would like to have that for your record.

CHAIRMAN LOWREY: We're very happy to have that for the record. We're very happy to hear that they are continuing that policy.

I think we might as well complete the Department of Natural Resources and ask Mr. Sven Anderson, secretary of the State Soil Conservation Board to make a statement at this time. Mr. Anderson? Is he here? (NOT PRESENT). (See Exhibit #15 attached.)

Well, as long as we have been discussing Fish and Game, let's hear from the Department of Fish and Game. We had Mr. Gordon listed, but I think there are two other representatives appearing. Why don't you both come on up? You'll have to state your titles now because I don't know what you are under the new reorganization.

MR. GLADING: Mr. Chairman, I'm Ben Glading, Chief of the Bureau of Game Conservation, and I'd like to introduce a fellow you all know but introduce him in his new capacity. It's Bill Harp who is the representative for the Commission under the new setup wherein the Commission is the policy-making Board.

CHAIRMAN LOWREY: Would you proceed and tell us what you have in mind?

MR. GLADING: Mr. Chairman, Mr. Gordon was unable to be here and asked that I represent the Department and also the Commission. I have a prepared statement that I'll read if you desire and turn over to the Secretary.

As the chairman and members of the committee realize, the Department of Fish and Game is not essentially a land-managing agency. We have only limited lands in the category that you folks are considering -- that is grazing lands, range lands -- something under

60,000 acres which we directly own and manage. However, we have a very great interest in public lands since our main products are very great users of it.

The California Fish and Game Commission, and the California Department of Fish and Game would like to call the attention of the members of the committee to the deer management policy for California which was adopted by the Fish and Game Commission on June 27, 1950. This policy is used as a guide for the management of deer by the California Department of Fish and Game. A copy of the policy is attached. (See Exhibit #8 - 2 pages).

We particularly wish to call attention to Items 1, 2, 3, 4, 5, 6, 8, 9, 10, 13 and 14 which are particularly pertinent to public lands matters. Other items have to do with deer management that would involve temporary reduction of the herds, and to matters involving public information.

An examination of the items cited above will show the basic thinking behind the whole deer management policy. This is to the effect that the basic resource should be protected. The range itself upon which deer, other big game animals, and livestock depend, is the foundation which must be kept firm. The policy clearly recognizes that big game, including deer, is only one user of public lands. It realizes that this basic resource, the range, must be allocated to all users, and also recognizes the fact that the prime use of such range, in general, is for livestock, within the over-all limits of multiple use.

The policy does contemplate, however, that game, particularly big game and hunting have a definite place on the public lands, especially the National Forests and the public domain. In this, our policy is in close agreement with the policies of the U. S. Forest Service and the U. S. Bureau of Land Management. With respect to hunting access to these lands, it is the Commission's and the Department's belief that within the limitations imposed by wise multiple use, these lands should be opened to legal hunting by the general public.

A specific case in point of our action in this matter has to do with recent agreements with the Boards of Supervisors of Lake and Mendocino Counties relating to the Cow Mountain area. This agreement opens an area of virtually unused public domain lands to public access and paves the way for developing the lands therein primarily for deer by brush management and providing water when needed. This example is cited to illustrate a management action made along the lines contemplated in Item 2 of the policy.

At this time, we would like to call the attention of the Legislative Committees to our program as a whole to further illustrate this policy in action. The Federal Aid portions of this program were recently approved by the Commission at their meeting in Alameda on May 9 and 10, 1952.

Our program at present is divided into two parts: (1) Research, and (2) Management. In the research field we are engaged in the following activities which have a definite bearing on public

lands in that these studies mostly are pointed toward better management of big game, particularly deer, on public lands. We would like to call attention to the following research projects that point all, or in part, to these objectives.

1A. FEDERAL AID IN WILDLIFE RESTORATION PROJECT, CALIF. W-41-R, CALIFORNIA DEER HERD STUDIES: The stated purpose of this project is "to conduct studies of deer populations in specific areas throughout the State. The studies will consist of making appraisals of the management problems involved, particularly in respect to range conditions, deer numbers, agricultural and livestock conflicts."

This is the over-all project which keeps track of range conditions and deer pressures in areas of the State which are considered critical. This project, after study, makes the basic recommendations for management of deer, including the reduction of overwintering use, and follows up actual management with studies to determine effects and to recommend future procedures. This project is coordinated with the following specialized projects dealing with deer.

B. FEDERAL AID IN WILDLIFE RESTORATION PROJECT, CALIF. W-31-R, EFFECTS OF BRUSH REMOVAL ON RANGES IN CALIFORNIA: The stated purpose of this project is "to make detailed statewide studies of brush management procedures. The data so obtained will be used to formulate sound methods for management of brush areas for improvement of wildlife habitat."

This project has been popularly named the "controlled burning project", although in truth controlled burning is only one phase of it.

The Commission and the Department take pride in this project as being one of the pioneer attempts in the State to improve ranges, with results already accruing to both game and livestock. The findings of this study have spurred other agencies into research along these lines and have resulted already in positive returns to the State in the form of management that is conducted by Federal and State agencies as well as private individuals in the rehabilitation of brush lands. We don't want to be bashful about this because we were right in the front as far as spending money on research on control of brush.

These brush lands, as the Committee members know, are one of the major range problems of the State, and are of prime importance over most of the foothill lands west of the Sierra crest on both private and public lands. This project to date has pointed out practical methods for the rehabilitation of brush lands, and has shown the benefits in erosion control and increased carrying capacity for both livestock and game that may accrue from application of such methods. These methods have been employed by the Game Department, as well as other agencies, and the program is growing to the credit of all. It should be pointed out that this project is a contract project with the University of California under the leadership of Dr. Harold H. Biswell of the Forestry Department.

C. FEDERAL AID IN WILDLIFE RESTORATION PROJECT, CALIF. W-46-R, GAME RANGE RESTORATION: The stated purpose of this project is "to investigate methods of restoring and increasing desirable browse species on game ranges. Principal emphasis will be given to those ranges in the Great Basin Region of California. This project will be conducted under a service agreement with the California Forest and Range Experiment Station."

This is a brand new endeavor which will actually start operation on July 1 of this year. It represents the results of about two years of effort on the part of the Commission to get such a project in operation. Difficulties in the way of earlier fruition have been attempts at inter-state cooperation in order to spread the costs of such a study among the various Great Basin States that might benefit, and the difficulty of obtaining competently trained, specialized personnel that are necessary.

One of the prime stated objectives of this study is to find a method of re-seeding browse species, particularly bitterbrush, in the Great Basin, or east-side portions of California. The facilities and personnel of the California Forest and Range Experiment Station, which agency is an authority on brush types in question, will be used.

D. FEDERAL AID IN WILDLIFE RESTORATION PROJECT, CALIF. W-25-R, A STUDY OF THE FOOD HABITS OF CALIFORNIA GAME BIRDS AND MAMMALS AND SPECIES AFFECTING THEIR WELFARE: A considerable portion of the effort of this over-all game food habits laboratory has been devoted to deer, antelope, and elk food habits as they relate to range conditions. This laboratory has given us valuable information as to what browse and forage species are eaten and the seasons of the year in which they are taken, as well as in what relative amounts. This information is of basic value in deer management studies in considering what effect a given herd is having on a given range.

The stature of this food habits laboratory is best gauged by the fact that other Western States use its facilities and findings in the management of their big game. This service is furnished by California to her sister states on a cost basis.

E. FEDERAL AID IN WILDLIFE RESTORATION PROJECT, CALIF. W-35-R, A STUDY OF DISEASES OF WILDLIFE SPECIES IN CALIFORNIA: Here again, a large portion of the effort of this project is devoted to the diseases of deer. Practical applications of these researches have been felt in the direction and control of hoof-rot in deer and in liver fluke control, both of which measures have livestock implications. Other big game diseases, such as hemorrhagic septicemia, are under investigation.

Now we depart from our investigative work, and examine what the Department is doing from a management standpoint for deer, particularly deer on public lands. These activities may be broken down into four categories:

2A. ACTUAL IMPROVEMENT OF BIG GAME HABITAT: The Department and the Commission have modified the former Federal Aid quail habitat

improvement program to include deer habitat improvement. This program includes actual brush control through controlled burning and mechanical removal, as well as re-seeding and providing water for better range utilization. In addition to the Federal Aid project, regular departmental funds are dedicated to these purposes. Expenditures have been made in some measure in every major section of the State. It is contemplated that this endeavor will enlarge as the quail job becomes complete and as more facts and techniques for deer range improvement are discovered.

B. DEER WINTER RANGES: About a decade ago, the Commission authorized the acquisition of a limited number of deer winter range areas in critical range areas in the State. Two of these deer winter ranges were purchased; the Boyle Deer Winter Range, comprising roughly 13,500 acres, and the Tehama Deer Winter Range, comprising about 43,000 acres. The stated purpose of these acquisitions was "to preserve the range so as to provide winter feed for deer."

The Department feels that the acquisition and management of these areas has done some good in the alleviation of local deer problems. However, it has become apparent to the present Commission that it was not advisable for the Department to attempt to own or control all of the critical deer winter ranges in the State; hence Item 6 of the policy adopted in 1950 states "to limit the acquisition by the State of deer lands, access roads or rights-of-way to those cases where unusual benefits will derive from the expenditure of moderate sums."

The Department does not have under consideration any addition to the deer winter range program other than more efficient operation of areas now under their control.

C. PREDATORY ANIMAL CONTROL: The Department has in its employ 38 Hunters and Trappers, 5 Lion Hunters, plus supervisory personnel necessary to carry out this program; however, at the present time, some of these positions are vacant.

While this program is geared primarily to the control of predators of big game, namely coyotes, bob-cats, and mountain lions, benefits also accrue to other users of the public lands. In addition to the above employees of the Department, whose activities either in whole or in part are devoted to the control of big game predators, the Department, through the Fish and Game Preservation Fund, annually pays bounties on an average of about 200 mountain lions.

Commission policy recognizes the fact that misguided predatory animal control can result in range depletion; hence Item 13 of the current policy states "to regulate the number of deer predators on the basis of local deer needs, concentrating control efforts on understocked ranges or ranges where hunters are fully harvesting the annual deer crop." In other words, we are trying not to compound our problem on over-stocked areas by providing predator control which will further add to deer numbers and hence further complicate the problem.

SENATOR SUTTON: Do you mean to tell me you are letting the predators breed? To keep the deer down?

MR. GLADING: Senator Sutton, it is my understanding that it is the Commission's wish in this matter -- is that we have only so many predatory control men to go around. They feel that their efforts are best spent on ranges where the deer are low rather than where the deer are high.

SENATOR SUTTON: I thought our ultimate objective was to eliminate all predators in the State. You can't breed them in one place and decimate them in another and get any place. I never heard of such a thing.

MR. GLADING: To return to the report: D. THE CONTROL OF DEER USE: Here we enter the extremely controversial and "hot" field generally known as "doe shoots", "antlerless deer hunts" or other designations, some of them less complimentary. An examination of the basic policy of the 1950 policy indicates that the Commission has met this problem courageously, "head-on." The policy states rather clearly that we will attempt to manage deer herds in the same manner that a wise livestock operator would operate his stock if he and his heirs proposed to remain in business on a permanent basis. It recognizes clearly that the range and its condition are basic to continued deer hunting in the same manner that a sound rancher recognizes that a given range will, on a long pull, only hold so much stock.

That the Commission and the Department are serious on this part of the program must be evident to all who have read the papers in the last couple of years. Generally, the Commission has authorized reduction in use, particularly over-wintering use, by providing for the harvest of surplus animals of either sex in areas where such reduction was indicated by detailed studies.

Much confusion has existed as to the Commission's aims in this matter, and much criticism has been heaped on the Commission and the Department as this program is put into effect. We are accused of playing into the hands of the stockmen by reducing deer herds in order that the range may accommodate more cattle and sheep. Actually, we do not contemplate ultimate reduction in over-all deer numbers, but rather reduction, temporary in most cases, of deer use on the range where such reduction is indicated. Experience has shown that the temporary reduction of deer numbers at the right time of year results in the reduction of animal use during the critical winter season, which results in better range conditions, which results ultimately in a healthier deer herd, including more bucks (and does!) in the hunter's bag.

The letter inviting us to appear here, signed by Senator Regan and Assemblyman Lowrey, requested the California Department of Fish and Game to furnish them with "an estimate of the size of the deer herds, preferably broken down by the new proposed districts." Such an estimate is furnished in the attached table (see Exhibit #9 - 5 pages). This estimate is based on the latest comprehensive survey of deer numbers contained in Game Bulletin No. 6 which is just hot off the press. It is entitled "A Survey of California Deer Herds" by William F. Longhurst, A. Starker Leopold, and Raymond F. Dasmann.

Several words of caution are in order as to the interpretation of the numbers contained in the appended tables. First, the deer herd unit boundaries as contained in the report do not coincide in every case with the boundaries of the proposed new Fish and Game Districts. Secondly, the estimates, although they are the latest statewide estimates available, were made in the period May 1, 1948 to March, 1950. Although we have no reason to believe that the estimates are materially changed since that time, this possibility does exist. I'd like to modify that a little bit and state that these estimates were based largely on kill figures obtained in 1947. For about a five year period, the California deer kill seemed to level off at someplace between 47,000 and 50,000. However, in 1951, our deer kill took about a 50% increase. We had about a 65,000 reported deer kill, so the possibility exists then that these figures that are presented to you need considerable adjustment.

And lastly, as the respective chairmen indicated in their letter, the figures given are "estimates"; they are not the result of detailed counts of deer numbers, but rather are based primarily on the buck kill by areas of the State, together with field observations of deer use of the range.

Before I conclude, I perhaps better summarize that table for you since you did ask for that in your last letter. It indicates that the Northern Region which comprises the counties of Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen and Tehama Counties has an estimated 269,500 deer which comprises about 26.4% of the total estimated numbers of deer for the state.

Sacramento Region (Glenn, Butte, Plumas, Colusa, Sutter, Solano, Yuba, Nevada, Yolo, Sacramento, Sierra, El Dorado, Placer, San Joaquin, Amador, Calaveras and Alpine Counties) has an estimated 144,000 deer which amount to about 12.8% of the estimated total for the state.

Bay Region (Mendocino, Sonoma, Lake, Napa, Marin, San Francisco, Contra Costa, Alameda, San Mateo, Santa Clara, Santa Cruz, San Benito, Monterey and San Luis Obispo Counties) has an indicated 298,500 deer or 26.6% of the state total.

San Joaquin Region (Stanislaus, Tuolumne, Merced, Mariposa, Madera, Fresno, King, Tulare and Kern Counties) has an indicated 190,000 deer or 16.9% of the total.

Southern Region (Mono, Inyo, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, San Diego and Imperial Counties) has an indicated 194,000 or 17.3% of the total.

The estimated total of deer for the State is 1,123,000.

In closing, I am sure that the Commission and Mr. Gordon, on behalf of the whole Department of Fish and Game, would want me to thank the Chairmen and members of both Legislative Committees for this opportunity to present this material to you, and further, I shall be happy to try to answer any questions you might have on this presentation or any other policies or activities of the Department.

ASSEMBLYMAN BELOTTI: Mr. Glading, in my district up in the northwest, I know that you are aware of the fact that particularly the sheep men are very much disturbed over the losses as a result of the predators, particularly the bears. I'm wondering now what the reaction will be when they read in this report that they may go as far in areas there of encouraging and protecting these predators where you feel that the deer population is low.

MR. GLADING: Mr. Belotti, I believe there is a little misunderstanding with respect to this predator protection. The policy states that in areas, and I might quote the type areas we are concerned with, for instance, "the interstate deer herd range where we have a proven overpopulation of deer, the Doyle deer area where there is also a proven over population of deer," we feel that to assign a predatory animal control man to those areas would further compound the problem until the range condition is taken care of. However, throughout the State generally, we do not contemplate any reduction of our predatory animal control efforts. I think that will answer both you and Senator Sutton's question.

SENATOR SUTTON: You are familiar with the area of land in Tehama County of some 42,000 acres for deer. Has the Department any plans for improving the grazing and forage on that for your deer?

MR. GLADING: Yes, we do have, Senator Sutton. As a matter of fact, it was mentioned in here in our research program. We have this contract with the University of California on control burning. Now, their prime efforts in the past few years have been in two areas of the State, first in Lake County and the second in Madera County. In recent months, Dr. Biswell, working cooperatively with our men, is planning to extend the research and demonstration work to our Tehama Deer Winter Range.

SENATOR SUTTON: Speaking of the Alameda Commission meeting and that federal fund of some million dollars, is that all earmarked for research?

MR. GLADING: Oh, no, sir.

SENATOR SUTTON: It seems that very little of it goes for real constructive improvement. There are many thousands of dollars for research. We've had a research staff of great numbers with our Fish and Game for years, and it seems that continual research is defeating the effort to get something done.

MR. GLADING: Senator Sutton, I do not have the exact figures with me --

SENATOR SUTTON: Research the patient, you know, until he dies.

MR. GLADING: I do not have the exact figures with me for the allocation that was made at Alameda last week, but it is my understanding and if my memory serves me correctly, about 25% of the federal aid funds which is only about half the funds spent for all of game -- just activities under the Bureau of Game Conservation -- about one-fourth of the federal aid funds are for research, but by far the greatest portion of those funds are spent for development and maintenance of waterfowl areas and habitat improvement.

SENATOR SUTTON: All that you've read here is research, isn't it?

MR. GLADING. Not all, but the first part.

SENATOR SUTTON: I've read the paper and practically everything there was for research.

MR. GLADING: About 25% of the funds are devoted to research. That amounts to about one-eighth of the funds of the Bureau of Game Conservation.

SENATOR SUTTON: The quantity of the funds I'm not sure of, but on the projects, it's about 90% research. The 10% construction may be the larger sums.

MR. GLADING: Senator, I'd be willing to furnish you wish a complete list of those projects and I believe you'd find that the majority of them are development.

SENATOR SUTTON: Well, they probably kept it out of the paper. Sometimes they're not complete.

CHAIRMAN LOWREY: Any other questions? Any questions from the audience? I hope you're not afraid of these microphones.

Mr. Wing.

MR. WING: Mr. Chairman and members of the committee, first of all, we want to express our very keen appreciation of the wonderful work the Department of Fish and Game is doing with reference to the matter of brush control to provide more feed as Ben Glading stated for both deer and livestock. Secondly, we want to express our appreciation for the work of the Department of Fish and Game in regard to the management of the deer herds in the same way, as he expressed it, as a wise stock man manages his own livestock and gets rid of the surplus every year. I don't think there is a Department of Fish and Game in the United States that is doing as constructive work as is our own Department here in California. They are certainly to be commended in that direction.

Now, as Mr. Belotti just mentioned, the bear problem in the north coast section of the State is a tremendous one. Also, in some of the Sierra Nevada mountains. We don't think we have secured the cooperation that is justified in the matter of the control of bears. We think we were given the run-around at the hearing before the Fish and Game Commission when it met at Los Angeles last February and also in January in San Francisco. We are hopeful that the Fish and Game Commission will have a review of this bear situation sometime in the near future. Furthermore, we believe that the predatory control work can be carried on in a better way than it has in the past twelve months or so. If these men are not doing predatory animal control work twelve months of the year, they are being put on other duties which has broken down the effectiveness of the work to a considerable extent. They've got some fine hunters but we believe because they've been put on other types of work that they are not in a position to do the most constructive work as far

as predatory animal control is concerned. Otherwise, we repeat, we think we've got a wonderful Department of Fish and Game here in California.

SENATOR SUTTON: Mr. Wing, could I make an observation? You are well aware that the legislature has caused the Fish and Game to be reorganized from top to bottom and that the reorganization has not been accomplished yet and eventually, it will be on the basis of five regional organizations. I can't see how you can be so extreme in your praise when the legislature was unsatisfied with the whole situation and reorganized it from top to bottom. That is coming along a lot slower than we'd like because we can't house the Department in Sacramento where we are bringing it back home to us. Were we wrong in reorganizing it?

MR. WING: Senator Sutton, I'd like to point out that any remarks I made related more or less directly as far as the Department of Fish and Game and the Commission affects the livestock industry. We are not conversant with the problems relating to fish and other matters of that sort.

SENATOR SUTTON: They're so closely related, Mr. Wing, that you'll have to take it all.

CHAIRMAN LOWREY: I'd like to ask a short question as to your rodent control. Are you doing any work on rodent control in Fish and Game in the areas you have under your jurisdiction?

MR. GLADING: Not to my knowledge right now.

CHAIRMAN LOWREY: I was thinking particularly of the squirrels which play a very definite part in range management or wild lands management, erosion and the other phases, and I was wondering, do you even contemplate doing any work in that respect?

MR. GLADING: Yes, that's true, where the problem arises. Now, to my knowledge, it hasn't arisen in any major effect on the two areas which we own and control, that is the Tehama and Doyle. Now, it is possible that I could be wrong there.

CHAIRMAN LOWREY: Did you by any chance in your report list the total number of acreage under your control?

MR. GLADING: The total acreage that we own and control as land managers are comprised in the Tehama Deer Winter Range of some 43,000 acres and the Doyle Deer Range is some 13,500 acres. Now, in addition to that, we have recently acquired by agreement with the Supervisors of Lake and Mendocino Counties a rough sort of control over the Cow Mountain area, but that involves on our part range improvement. We do not actually own the land. We propose to improve the range for the deer.

CHAIRMAN LOWREY: Do you have any negotiations under way to acquire any lands through exchanges with the Bureau of Land Management or otherwise acquire additional lands for any purpose in the Department of Fish and Game?

MR. GLADING: Are you restricting that question to range lands in the Bureau of Land Management, or do you refer to our whole land acquisition program?

CHAIRMAN LOWREY: Well, I was thinking particularly of the Bureau of Land Management.

MR. GLADING: No, we have no acquisition program with the Bureau of Land Management. However, we have a gentlemen's agreement -- you wouldn't even call it a gentlemen's agreement -- we are interested in any piece of public land that is not being utilized right now in the hopes that we may improve the range for deer.

CHAIRMAN LOWREY: In other words, you are contemplating a program for managing federally unused areas for wild life.

MR. GLADING: That is correct.

CHAIRMAN LOWREY: Do you have to enter into a contract?

MR. GLADING: The only contract that we enter into -- a gentleman from the Bureau of Land Management mentioned it in connection with our Upland game program -- we have an agreement with the Bureau of Land Management whereby we do any development on their lands, and he mentioned that we have some 400 or 500 gallinaceous guzzlers which are bird-watering outfits. Actually, we have gone into a deer watering outfit in the desert areas, too, on public domain areas. Whenever we install one of those, we get an agreement with the Bureau of Land Management to the effect that we put it in and will maintain it. I want to make one thing clear, Mr. Lowrey, the Department is not interested on public lands of putting anybody out of the grazing business. We are interested in multiple use of public lands and that, of course, in our way of thinking means hunter access to them, and if they are not going to be developed by anybody else and are largely unused by anybody else, we'd like to develop them for deer.

CHAIRMAN LOWREY: I was just wondering if, particularly in the brush areas, you had a program underway whereby you'd go in and improve those areas for the benefit of the wild life there.

MR. GLADING: Cow Mountain is the only one of those that is to the agreement stage where we've actually started. However, we have very rough tentative plans on other similar areas in Lake County and counties surrounding Lake County.

CHAIRMAN LOWREY: Napa, for instance?

MR. GLADING: Yes, sir. I'd also like to add that we have cooperative agreements with the U. S. Forest Service for developing brush lands to the advantage of deer. We foot the bill, and they let us use the land for that purpose.

MR. McCABE: I'm H. L. McCabe from Upper Lake, and I'd like to ask Mr. Glading a question. What is the agreement that you have with the Mendocino National Forest relative to development of the burns?

MR. GLADING: It is my understanding that certain brushlands in the Mendocino National Forest -- that we will foot the bill for opening those lands up.

MR. McCABE: I have in mind with reference to the burns by wild fires.

MR. GLADING: To my knowledge, sir, we have no agreement on any wild fire burns. Any wild fire is their problem strictly. All we're interested in there is largely a problem of the mechanical removal of brush.

MR. McCABE: Well, as a matter of fact, haven't you -- didn't you have an agreement whereby you seeded certain areas of the burn on the south end of Bartlett Mountain and also at Pilot Grove?

MR. GLADING: Yes, I believe we did as far as reseeding is concerned. We've had several agreements with the Forest Service. One comes to my mind now on the Modoc National Forest with respect to a large burn in the Devil's Garden area, and I believe that you are right that there were some reseeding agreements in other forest areas.

MR. McCABE: Well, wasn't it an agreement between you and the Forest Service that livestock would be excluded from those burns where you reseeded?

MR. GLADING: Not to my knowledge, sir. It's possible, but not to my knowledge.

MR. McCABE: Well, I understand that the agreement was that where you seeded that the livestock would be excluded and that being the case, the stockmen could be shut out of every burn in the State of California.

MR. GLADING: I'm sorry, but I don't have the details of that. It's possible that such does exist but maybe some member of the Forest Service could help clear that up.

CHAIRMAN LOWREY: We have the Superintendent of Mendocino National Forest here and perhaps he could give us the answer to that right now.

MR. THOMAS: I am Leon R. Thomas, Supervisor of the Mendocino National Forest. Yes, I would gladly attempt to clear that up. The work which is being done on the Mendocino National Forest and the work which has been done on the Mendocino Forest is in line with our management plans for that particular area. We, of course, believe in multiple use and part of the area which is suitable for game could be managed for that purpose; however, not to the exclusion of other uses depending upon the capability and suitability of the area for the various uses, and particularly on the needs of the people so involved. But we have no agreements of any kind with the Fish and Game Department whereby they are doing work within the National Forest where we are limiting the results of that to game only. In other words, they are in line with our management plans and they are giving us the money. We are using the money and we are doing the work within that area.

CHAIRMAN LOWREY: Does that answer your question, Mr. McCabe?

MR. McCABE: Yes, but that isn't in line with a statement one of the men in the National Forest made in the presence of me and two or three others.

CHAIRMAN LOWREY: Are there any other questions? If not, we want to thank you very much. Mr. Harp, did you have anything to add.

MR. HARP: I was just listening, thank you.

MR. WING: Mr. Chairman, I don't think that we can overemphasize the fact that in any brush control work that unless there is game management along with the brush burning it will not result in any ultimate benefit to the livestock industry. This entire program of brush burning throughout the State will not benefit the livestock industry in furnishing more meat to the citizens of the State unless there is game control along with the burning of the brush. In other words, you burn the brush and the deer will come in and take up the extra feed because in a great many cases there are too many deer today in these brush areas, and there is not adequate food for these deer. We emphasize also the point made by Mr. Glading that there must be control of these deer -- antlerless deer hunts -- if we are to have more meat for the 11,000,000 people in the State of California.

CHAIRMAN LOWREY: Thank you, Mr. Wing.

Mr. Woody, do you have a comment to make on this subject? This is Mr. Woody of Woody, California, in Kern County.

MR. WOODY: Mr. Chairman and gentlemen, my comment is only short. From the burns we've had down there, our browsing has come up and the deer have followed right in on it. I notice that the deer are coming down out of the mountains and are hitting our lowlands and are grazing our feed. They're getting a little too thick for our benefit. I feel as though they need to be controlled. That's all.

SENATOR SUTTON: You speak of the deer coming down on your newly burned areas. Is there brush areas above that they come through that belongs to the federal government and the state that could be burned and provide feed for them and browse at a higher altitude?

MR. WOODY: That's true, Senator Sutton. There are brush areas that the deer come through.

SENATOR SUTTON: And if comparable burning at the higher elevations primarily for the deer, that would balance it?

MR. WOODY: That's right.

CHAIRMAN LOWREY: There are three other gentlemen sitting back there and I know they have something to say on this subject -- and always, John O'Neal has something to say. Mr. O'Neal?

MR. O'NEAL: Mr. Chairman, my name is John O'Neal and I'm from Madera County and I'm a brush burner. Now, you are talking about these deer that you want to feed and you want to manage. I think that we've got plenty of feed in the State of California to feed these deer, but the trouble is that your upper country has gotten so filthy that there's no place for your deer to feed up there. Consequently, when we burn this lower country off under these controlled burns, why down come your deer on us.

Now, you take in our country and especially in a field that I had, I burned it two years ago and there wasn't a deer in that field at that time. Today you can go down there and I guess those deer are going to make a permanent home down there. There are 17 deer in that field. Now, if they keep on coming after me that way, maybe I'd better get in with Ben over there and get his hunters out after me, and then what will I do with my cows? I don't think these deer come so much after your -- they browse sprouts, but I still know they are a good deal like Al Spencer's sheep. If you've got good grass, they'll leave the sprouts alone and I don't know whether they'll keep our brush patches down very much or not, so I'd be in favor of getting rid of this deer. That's all.

SENATOR SUTTON: Mr. O'Neal, do you think there could be provided by proper range or back country management proper feed areas for these deer?

MR. O'NEAL: I do.

CHAIRMAN LOWREY: Do you other gentlemen back there wish to make a statement? Mr. Barnett? Mr. Emrick?

MR. BARNETT: I'm Charlie Barnett from the Kern County Forestry and Fire Department in Bakersfield. I'm not a rancher nor do I have to worry about the deer coming down or anything like that. However, we are interested in the controlled burning in our county and we are trying to cooperate with the ranchers and give them all the help that we can in an advisory capacity only, with some standby. But we can understand their problems because we realize that they are legion. We do stand ready to give them a hand at any time that we can, and I know that when they are talking about the deer coming down out of the brush country, I can readily agree with them and know that they are telling the truth on this matter because I've seen it myself. So really that's about all that I can say to something like this because, after all, I'm not a rancher.

CHAIRMAN LOWREY: You come from the Kern County Forestry and Fire Department? Well, now, you have an agreement with the State where you manage the fire setup in your area?

MR. BARNETT: Yes, sir, we manage the fire setup within our county for the California Division of Forestry.

CHAIRMAN LOWREY: Are there any further questions? Thank you very kindly.

If there are no further questions, I wonder if Mr. Beatty is present. Could we hear from you at this time?

MR. BEATTY: I don't think that I have any comments to make. It has been very interesting to be here and be present for the discussion.

CHAIRMAN LOWREY: Well, Mr. Beatty, I had hoped that we might have you tell us something about your revegetation of the meadow areas up in your locality which I understand you are carrying on. Is that correct? I think we are all interested in it. After all, we're interested in forestry and what the foresters are doing, and we would like to have you give us the benefit of your experience in that regard.

MR. BEATTY: Thank you, sir. Mr. Chairman and members of the committee, I'm Bill Beatty, a forester with the Shasta Forest Company. We are a cooperative corporation managing land for the heirs of the Walker family and the Red River Lumber Company. We manage lands in Siskiyou, Shasta, Tehama, Modoc and Lassen Counties. One of the projects that you were interested in then is possible management that we are doing on what we call our home ranch at Westwood.

On that particular ranch, we have been cooperating with the man we lease the ranch to in improving the grazing on that particular area. It's a meadow type of about roughly 4,000 acres of meadow. PG&E also holds land in common with us there, and they are working along with us on the same sort of management. We have attempted to build fences and manage the grazing through some of the fields that we have. We have a chance to spread water by the use of better ditch system, installation of a better canal to bring water over more of the acreage of the ranch. This was started in 1949. The real results are not to be determined at this time. I think it is a little early to say just how we have improved that capacity. We do know that our permittee is running more stock, but we do have some problems. You just can't spread water indiscriminately over land and produce the most palatable forage grasses, and we realize that in some places we are producing a few marshy areas that will require more intensive management and will probably have to go into some drainage to keep from doing that. We have done some reseeding with success on that particular meadow, but most of our work is done by permittees working on their own behalf with our cooperation in trying to better their range setup. It is mostly a summer range proposition.

SENATOR SUTTON: How many months during the summer would be the spread?

MR. BEATTY: Most of our ranges run from about May to October.

SENATOR SUTTON: Thank you.

CHAIRMAN LOWREY: Thank you very much, Mr. Beatty. Any questions?

SENATOR SUTTON: What grass seems to be the best -- I mean the combination?

MR. BEATTY: We've had some success with an orchard grass, meadow fescue and blue grass, in that particular setup.

CHAIRMAN LOWREY: We were interested in knowing a little bit about your program up there because it is interesting to note that the lumbering industry and those who own the large acreage are showing a definite inclination to improve the carrying capacity of these cutover areas and also the meadow areas.

Mr. White, President of the Long Bell, had intended to be with us and give us the benefit of his company's experiences in this regard, but I had a long talk with him on the 'phone yesterday from Longview, Washington. They are settling a strike up there today, and he didn't feel that he could very well leave just at the time when they were settling the strike. He did want me to mention the fact that he was very sorry that he couldn't be here but he was just afraid of the repercussions if he left the negotiations when they had proceeded as far as they had as of yesterday.

Well, I don't know in what order to continue here. Perhaps the right thing to do and the equitable thing to do is to go right down the line and go to the University of California.

Yes, Mr. Wing?

MR. WING: We've heard reports of agreements existing between the Soil Conservation Service and the State Land Department. I wonder if there is anyone who has any information on that?

CHAIRMAN LOWREY: Well, inasmuch as you raised the question, let's hear from Mr. Ireland. Perhaps this will be a short one.

MR. IRELAND: (State Lands Division). I'm sorry, I didn't hear the question.

CHAIRMAN LOWREY: Well, Mr. Wing raised the question of agreements being negotiated between Soil Conservation and State Lands. Do you have any information in that regard?

MR. IRELAND: No, I haven't. I haven't any information at all. The first thing I heard about that was a meeting up in Bieber, I believe, on the 7th of May, to discuss that, but I couldn't go up and I haven't got any report of that yet.

CHAIRMAN LOWREY: You don't know whether the State Lands Commission is entering into an agreement or proposed agreement?

MR. IRELAND: They haven't entered into any agreement.

CHAIRMAN LOWREY: Well, are they negotiating in any respect whatsoever?

MR. IRELAND: Not that I've heard of, and I think I'd hear of it.

CHAIRMAN LOWREY: Well, do you have any lands in a Soil Conservation District?

MR. IRELAND: Well, I understand there are about six sections in that district -- Pit River Soil District, is that the -- ?

CHAIRMAN LOWREY: I'm asking you. Don't ask me?

MR. IRELAND: Well, the only one I've heard about is one that Mr. Lindsay sent me a notice on that there was going to be a meeting, and he told me that there were going to be about six sections of State school land within the Pit River Soil Conservation area and I haven't checked it up. I wrote and told him that if I had a map of the District that I could determine if there were any school sections -- State lands -- within that area.

CHAIRMAN LOWREY: Well, have you entered into any such agreements in any other part of the State?

MR. IRELAND: No, that's up to the Lands Commission. We haven't even --

CHAIRMAN LOWREY: Well, you represent the Lands Commission, do you not?

MR. IRELAND: I'm representing the Division of State Lands of the Lands Commission, yes. We're a division within the Department of Finance, but the Lands Commission makes all the policies and we administer the -- well, we do what they tell us to.

ASSEMBLYMAN LINDSAY: I think it might be of interest to the whole group here to have a complete clarification of this because I have been connected with it since it's inception.

The National Soil Conservation Districts Association has an agreement with the Federal agency on the Washington level to set up a pilot district in each state on which all the federally-owned or public lands would receive a conservation plan equal to what is normally prepared on a private land. The Pit River Soil Conservation District was selected in California as this pilot district.

It is customary that when this district is selected that all agencies owning any type of private land are invited to set in on the discussions on the plan for the whole district. Normally, these would include lands held by the Bureau of Land Management, the U. S. Forest Service, the Indian Service, some state lands or county lands, the park lands, any type of public lands.

We held such a meeting in Bieber, and the agencies were invited there and when a land status map was put on the wall, why we had completely overlooked the possibility of having any state lands under the State Lands Commission being included. We found that there were about six square miles of school lands in this district.

Now, the Soil Conservation District up there is a legal political body of the State of California, the same as an Irrigation District or a Reclamation District or any of the rest of them, the idea being that the local directors of the district sign a memorandum of cooperation usually with the U. S. Soil Conservation Service to furnish technical assistance to do conservation work on the

private lands within that district boundary. On the 7th, a meeting was called of only the planning technicians. The first meeting, which I chairmaned as the Chairman of the Public Lands Committee of the State Association of Soil Conservation Districts of which I am a President of a District Board, had nothing to do with the legislature, of course, but we called the meeting. The agencies attended. We have started the work program of doing the conservation job on all these public lands.

When it became apparent that there were school lands in the district, we invited the State Lands Commission to set in on the discussion, and that is where the letter came from me to the State Lands Commission telling them that there were about six sections of their lands in there and inviting them to set in on the discussion. I received a 'phone call from, I believe, Mr. Ireland asking me about this and telling me that they had no technicians, and I knew they didn't. I said that it would be possible for them to enter into an agreement with the district itself, the board of directors, so that the lands held by the Commission could be included in the final plan.

Now, that's all there was to it. It's only in the preliminary stages to date. A meeting, I was informed, was held yesterday again by the technicians of the various agencies which will represent the lands that are being held: The Bureau of Land Management, the U. S. Forest Service, the Soil Conservation Service and the Indian Service. They have invited in the County Agent, representing the Extension Service, the Fish and Game people of California, and the Federal Wild Life Service -- all are taking part in this plan. I'm sorry that the Lands Commission of California wasn't in on the first meeting or they would have been completely informed. It was an oversight on our part that they should be represented because they have lands within the district boundary. Now, these lands are already included in the district more or less as a state policy. Incidentally, some of the park lands of the state are also being included in soil conservation districts on their erosion problems -- to take care of those only. Now these are only plans for development. It is hoped that when the final plan is finished that it will be presented to the various agencies, and we hope they will secure the necessary funds to carry out the plan. That's the story on the Pit River Soil Conservation District.

MR. IRELAND: That's the first I've heard about it except from your letter.

CHAIRMAN LOWREY: Well, then it would be necessary for the State to put out the funds to carry out their part of any program that was instituted. Is that correct? On that six sections?

ASSEMBLYMAN LINDSAY: On that six sections, providing that they agreed that that was necessary and providing that the legislature was agreeable that the erosion problem and the other problems that had been determined on there were serious enough to warrant the expenditure.

MR. IRELAND: Well, Mr. Lindsay, suppose the Commission doesn't desire to enter into this agreement?

ASSEMBLYMAN LINDSAY: Well, then, we will have in the total area of the district there will be six square miles that will not be planned. That's all.

MR. IRELAND: I see. Well, wouldn't we be permitted to go ahead and sell that school land the same as we are the other public lands of the State?

ASSEMBLYMAN LINDSAY: Why, certainly. There's nothing compulsory about this. It is simply a plan of conservation on those lands. That's all there is to it.

MR. IRELAND: We wouldn't be required to withhold them from sale. That's what I was --

ASSEMBLYMAN LINDSAY: There's no requirement at all on anybody. We are trying to establish a constructive policy here in this way. For many years, for instance, on our Forest Service lands which are the best known lands in the state, they have received smaller and smaller appropriations for conservation work -- gully control, meadow improvement, water distribution, and everything that pertains to livestock use. We hope that we can show Congress that this attitude has been wrong. That if we go in there and plan -- actually plan the needed control work and the needed improvement work and go back with a plan on paper and from maps rather than just words and opinions that perhaps we can get some funds to try to start a long time program of range building. That's the whole idea behind this. Each agency maintains its own individuality. This is simply a method of getting something done, that's all.

CHAIRMAN LOWREY: Well, who head this program? Mr. Anderson?

ASSEMBLYMAN LINDSAY: Mr. Anderson has nothing to do with it. He only sits in as a technical adviser representing the State Soil Conservation Commission. The program will be under the direct control and supervision of the Board of Directors of the Pit River Soil Conservation District.

CHAIRMAN LOWREY: Well, the State Soil Conservation Board, then, has no supervisorial prerogatives?

ASSEMBLYMAN LINDSAY: That's right. It does not.

CHAIRMAN LOWREY: I wonder, is Mr. Anderson here by any chance at this time?

ASSEMBLYMAN LINDSAY: No, he hasn't come in.

CHAIRMAN LOWREY: Is Mr. Perry here? Could you add anything to this, Mr. Perry?

MR. PERRY: I am R. D. Perry, Assistant State Conservationist, Soil Conservation Service. Mr. Chairman and members of the committee, the only thing that I might add in regard to the Pit District is that it is sometimes called a coordinated land program, and I think it is important there that you realize that the owners of the private lands,

the farmers represented by the Soil Conservation District Directors, are leading this program and that it is the intention that the program that will be developed on the public lands will tie in with the program that they are using on their own lands and that they will go ahead with a program of improvement soil conservation on their own land at the same time that the public agencies go ahead with their program, so it is a complete overall program rather than the private land owners doing work and perhaps erosion or uncontrolled runoff coming off to the public lands. I think that's one important point that your committee should recognize.

CHAIRMAN LOWREY: Well, then who is the end product here -- who has the final authority in this program?

MR. PERRY: As Mr. Lindsay stated, each agency handles the program on the lands on which they have control of. For instance, the Forest Service would handle any program of improvement on their own lands; the Bureau of Land Management the same way; and the few sections of state land the same way if anything was decided that they wanted to go ahead with the program on that. The private land owners, members of the Soil Conservation District, would handle their own program.

CHAIRMAN LOWREY: Well, now I have a statement here that at this meeting on the 7th in Bieber a question was raised by one of the local farmers up there as to the advisability -- and this is the way it was stated, "A question was raised as to the advisability of spending $5 to $10 for a soil survey on land that is not worth over $1.50 per acre." Now, would you have a comment on that?

MR. PERRY: I would think the man was definitely right if there were any intention of spending $5 to $10 an acre on a survey of land that was worth $1.50 an acre. There is no intention that that should be done. In other words, the meeting the other day was to determine procedure whereby the various agencies would go ahead and get the inventory -- the factual information of what's there now. On those lands that might be classed as worth $1.50 an acre, the survey will probably cost in the neighborhood of 10¢ or 15¢ or maybe less. It may be made from aerial photos and not even go over it -- it may be extremely wild lands.

CHAIRMAN LOWREY: Well, who's paying for this? For instance, on the survey of the six sections of state lands? The preliminary survey?

MR. PERRY: If the six sections of state land is handled the same as the other agencies, they would provide the means or request certain agencies to cooperate with them in getting the information that they do not have the technical assistance. It's so small a part of the whole thing that I believe if the request went to the Soil Conservation District Directors asking that they be given assistance in getting the inventory on the six sections, I rather imagine that the District Directors would see that that was done through technical assistance that is furnished to the districts, and it could be done, if the State asked for it.

CHAIRMAN LOWREY: You say technical assistance as furnished to the district. What do you imply by that?

MR. PERRY: Perhaps your committee realizes that the principal job of the Soil Conservation Service is to work with private land owners on private property. In other words, Congress makes the appropriations for that purpose, and under agreement with the District Directors of the Pit Soil Conservation District, we are doing certain things that they have requested us to do. One of them is to assist in this survey by carrying on conservation surveys, range surveys, and such engineering surveys as might be needed for water development as their part of the coordinated program on private lands to tie in with the program on public lands.

CHAIRMAN LOWREY: Well, then it is financed by the Federal Soil Conservation agency -- the technical assistance, then. Is that correct?

MR. PERRY: Some of it. The Soil Conservation District by State law may ask and receive assistance from any agency that they can get help from. They have asked us to help on certain phases of it. There are many phases that we don't help on. They can get assistance from the college if the college has facilities and wishes to, the Forest Service and any other agency that may be willing to assist them on their particular problem. For instance, state highways and county highways are often the problem through a district. With the District Directors representing the local people, they often work directly with the County Highway Commission and the State Highway Commission who furnish the technical information and carry out a program, for instance, to take care of flood waters and something of that kind.

MR. SNYDER: Mr. Chairman, this is T. Joseph Snyder of the Bureau of Land Management, and I happen to represent the Bureau of Land Management on the committee that is working on that Conservation District. Now, any of those state lands that are range lands and that are leased by local people using the federal range -- part of their range setup -- we would be very happy to cooperate with the State Land Board and get all the information that is necessary to set up a plan. Now, if they are not part of the range lands, then probably we won't be particularly concerned. The same thing is true of some of the private range lands, if they are used in connection with federal range lands, we want the whole picture in order to plan not only the improvement but the management of those lands. Now, I just wanted to say that in order that maybe you could shorten your discussion here a little bit.

CHAIRMAN LOWREY: Do you by any chance call in the Extension Service and their specialists when you are making these studies? Do they play any part in this picture?

MR. SNYDER: Extension Service, as I understand it, is primarily an educational institution and we're very happy any time they'll get into the field and --

CHAIRMAN LOWREY: No, I'm not saying if they will, I'm saying are they now actively -- the University with their research department -- are they a party in these studies or not?

MR. SNYDER: They're invited. I don't know that they are taking part. They have been invited. The Extension Service has, and we'd be most happy to have them work in there if they are not. However,

when it comes to setting up and making an inventory and a study on the federal range lands, we propose to do that ourselves.

CHAIRMAN LOWREY: That's on your own areas.

MR. SNYDER: That's right.

CHAIRMAN LOWREY: Well, then you also do it on the private lands inside a Soil Conservation District but not outside a Soil Conservation District, is that correct?

MR. SNYDER: No, we do it outside Soil Conservation Districts.

CHAIRMAN LOWREY: You do, but the Soil Conservation people themselves --

MR. SNYDER: Providing the range is a part of the unit used in connection with federal lands. Now, if there is a block of private land which has no connection with federal range use, we are not concerned with it. That's something for the rancher and probably the Soil Conservation Service to figure out -- how he is going to improve and manage that, but if the lands are intermingled and used with federal range, then we will set up a plan on the whole things. Does that answer your question?

CHAIRMAN LOWREY: Thank you.

ASSEMBLYMAN LINDSAY: I might point out that almost 27,000,000 acres or over 25% of the State of California is now included in the 74 Soil Conservation Districts and the Soil Conservation Service, a federal agency, is the primary supplier of technical assistance to those districts, but like in the district that I am connected with, we are working with the State Board of Forestry, the Extension Service, the Soil Conservation Service, and the U. S. Forest Service at the present time. Getting everything that we can possibly get out of those particular agencies to assist in the management of lands in conjunction with the private owners and with the development of better practices on the private lands themselves.

CHAIRMAN LOWREY: You may wonder why I'm asking so many questions, but I think we should have all of the facts possible on the record because one of the purposes of the hearing, as I interpret it, is that we want to correlate our activities so that one agency isn't duplicating the activities of another agency. One agency do one phase of the work and the other one do another, so that we can accomplish the whole purpose with the least expense to the taxpayer and that's the reason I ask all these questions.

ASSEMBLYMAN LINDSAY: Well, you see that's exactly the reason we have this committee. All the agencies sit down and decide which agency is going to do what and then they write a final report together. In that way, we completely eliminate the duplication of work between some 14 different state and federal agencies that would be interested in this kind of work.

CHAIRMAN LOWREY: Did you have any other comment while you're here, Mr. Perry?

MR. PERRY: Thank you. I think that covers it.

CHAIRMAN LOWREY: Then, Mr. Ireland, I would like to ask you what program you are pursuing, or what your policy is regarding the public lands of the State -- that is, lands that you are leasing and lands that you are managing.

MR. IRELAND: Well, Mr. Chairman, I have a prepared statement here regarding the --

CHAIRMAN LOWREY: Would you care to comment on it and submit it?

MR. IRELAND: There isn't very much of it. I can read it if you like or turn it in.

CHAIRMAN LOWREY: Well, you might give us a resume of it and then turn it in for the record.

MR. IRELAND: Until October of last year, grazing leases were issued under competitive bidding at a minimum price of twenty cents per acre per year. This was found to be too high a price. Prior to the twenty cent minimum, which was fixed about 1943, 45 to 60 thousand acres per year were leased at a minimum price of five cents per acre under competitive bidding. When the twenty cent minimum price became effective, the majority of the lessees failed to renew their leases and now we have only twenty leases for a total of 7,438 acres, at a minimum average of twenty-nine cents per acre per year. The highest price of the current leases is seventy-five cents for 160 acres. The majority of these leases are in the grazing districts and are leased for the purpose of acquiring compensatory use of government grazing land. Since the new rules and regulations were issued, leases are no longer issued on a competitive basis unless it is in the public interest to do so. Under the present policy, the leases are issued after negotiating with the lessee, the annual rental being determined by the carrying capacity of the land in animal units, similar to the procedure followed by the federal government.

At the present time, there is quite a bit of activity in the southeastern part of the State where stockmen are leasing several hundred thousand acres of government land. Within the perimeter area of the government land being leased, the 16th and 36th sections of State land have been and are being used by the stockmen without obtaining leases from the State, the reason being that the minimum annual rental of twenty cents per acre has been excessive. However, when it was learned by the stockmen that they could lease State lands on the same basis as the federal government lands, they immediately began to make inquiries and upon receiving confirmation from the Division of State Lands they began sending in their applications; none of the applicants has offered less than one cent per acre per year. The government lands in that area are leased at one cent per acre per year or less. The average is about 4/5 of a cent. There are approximately 80 thousand acres of State school land within the area being leased by the government of which the State already has received applications to lease approximately 20 thousand acres and it is expected that the entire 80 thousand acres will be leased by

the State to the government lessees as soon as negotiations can be completed.

In addition to the State school sections embraced within the military reservations which have been leased to the federal government, the State is now negotiating with the federal government for the exchange of over 37 thousand acres of scattered school lands in the Inyo-Kern Marine Gunnery Range for an equal area of government land in the Mojave Grazing District in one compact area. Favorable reports have been made by the government field examiners and recommendations for the approval of the exchange have been sent to the Washington office of the Bureau of Land Management. When the managers of the Grazing District were notified by the Division of State Lands that the grazing lands selected by the State within their district would be leased on the same basis as the government lands, all objections to the exchange were withdrawn and from that it appears that the exchange will be consummated as soon as the details of publications, etc., can be completed. If and when the State receives the government lands so selected, probably there will be a demand for them for leasing by the present holders of the leases of the government lands in that area.

Except for this exchange, the only other exchange now pending is one that was applied for at the request of the State Division of Forestry. In this instance, approximately 23 thousand acres of school lands scattered throughout the State and embraced in National Forests have been offered in exchange for approximately 44 hundred acres of government land in the Mountain Home State Forest in Tulare County, which government land is contiguous to and within the State Forest lands and will round out that area in a solid block. The State lands and the government lands have been appraised by both State and federal appraisers and the two totals are considered of approximately equal value. The State school lands so offered, in many instances, are isolated and inaccessible and are much more valuable to the federal government for the purposes of water shed protection and timber development than they would be to private holders. Many times in the past it has been found that after the timber is removed from the school lands sold by the State to private holders the lands were allowed to go back to the State for taxes having first been rendered practically useless for any further timber development. In connection with this exchange, it might be stated that all of the school sections offered to the United States have been on the vacant State land lists and subject to sale for many years and only have been withheld from sale subsequent to their inclusion in the exchange.

CHAIRMAN LOWREY: Do you contemplate any improvement on any of the areas now held by the State?

MR. IRELAND: By the State Lands Commission? No, the State doesn't do any improvement on their lands at all. Their main function is to put the lands on the tax rolls, sell them, and put the money into school lands fund or lease them and we prefer to sell them, though, if possible.

CHAIRMAN LOWREY: I thought maybe if you put them in a little more presentable condition you might be able to sell them with a little more ease.

MR. IRELAND: I'm afraid we couldn't get what we put into them if we did.

ASSEMBLYMAN LINDSAY: In other words, what you've got left is the scrapings in the bottom of the barrel.

MR. IRELAND: That's correct. The best has been picked over many years ago.

CHAIRMAN LOWREY: Thank you. Any more questions?

I know the time is flying by, but if you people can suggest a speedier method, the chairman will certainly be happy to receive your suggestions.

We're going now to the University of California. I had failed to put Dr. Viehmeyer on this list inadvertently, and he told me this morning that he wasn't particular or not whether he was called on. Is he still here or has he left? (He was still present but delegated his time to other faculty members.)

Then, we'll call on Dr. R. Merton Love, the Range Improvement Program.

DR. LOVE: I'm R. M. Love of the University of California, Division of Agronomy at Davis. I've been there since 1940 when the Division activated their range research program which included work on brush burning, although we weren't doing any burning, but we were doing some seeding of trial plots on such burns so that by the time State laws were such that controlled burning program could be put into operation, we had enough information that the Division of Agronomy and the Extension Service through their cooperation could put forth a bulletin, "Improving Californis Brush Ranges" which was published in 1947. That has since been revised, and I have given the Chairman a copy of that for the records, the revision having appeared in 1952 again through the cooperation of the Division of Agronomy and the Agricultural Extension Service. (See Exhibit #10 attached.)

The reason we were able to be ahead on this whole game was through the cooperation of the livestock people. That is, they themselves have been working at this improvement of the range for a long, long time, and it was through the possibility of improving land from one end of the State to the other as carried on by the progressive livestock people plus the help that they had received from the Extension Service and then finally from the University of California Experiment Station, itself, that we have been able to get the information to the farmers. Now, I just wanted to put that in for the brush records since so much has been said about brush today.

I don't know how much of the federal-owned and state-owned land is not brush and timber. Actually, for the past eight

years, the work of our Division has been primarily accented toward the lower elevations. These adaptation trials have been carried on through the Extension Service. As a result, you can see that on Table 3 in Circular 371, "Improving California Brush Ranges", there is listed the adaptation of the species of range grasses and legumes that can be used throughout the State of California not based on one year's work or two years' work, but carried on continuously from 1947 until 1952 which, of course, includes poor years as well as good years. We have been able to zone the State. There is a zone map on page 19.

However, we found out that one of the main problems in improving the range was knowing a little bit about the agronomy of the range. In other words, we have to learn to treat the range as a crop to see what kind of grasses and legumes are growing there and how by handling them. I heard Senator Sutton refer to a statement made today as an astonishing statement. I don't know whether that meant that he didn't agree with the statement or he was amazed that such a statement would be made. But we have had some work -- and Dr. Hart will bear me out on this, I am sure, and so will others -- where we had a plot fenced for two years on the Brown Hereford Ranch near Wilton in Sacramento County. It was fenced not for the purpose of protecting it but because Dr. Conrad who has done the fertility work in our Division had fertilized plots in there and wanted the total yield. So the livestock were kept out of this plot for two full years. At the end of the second year, it was almost all bunco grass rather than the more desirable grasses. That's why complete protection does not pay on our Mediterranean type climate here in California. It just encourages the weeds. It is just the same as if you planted a garden at home and put a fence around it and just stayed away from there. It would be all right to go fishing, but you wouldn't have much of a garden to come back to in the fall. You'd have nothing but weeds. That's the thing we had to learn.

Then, at the same time, we were introducing plants from all over the world -- probably more than 3,000 different varieties of grasses and legumes have been tested in California some of which have done very well. Some have been in the State a long time, some a short time. The only one that I will mention here particularly is rose clover which came to us from Turkey. We didn't compare it at Davis on our Yolo loam with alfalfa and other high producing plants, but we read in the flora of Europe that this clover grows on sterile soils and waste places. Of course, I know us Californians shouldn't admit having that type of land, but there are a few acres in California that could be classed as sterile land and waste places. And lo and behold, this rose clover did pretty well on this type of land. It's just a transplanted wild flower, but it produces pretty good feed and under better conditions will produce more, but it showed us what we really had been feeling towards and what Australians have known for a long time and other parts of the world -- that you build up the soil by the use of winter annual legumeswhich, in turn, provide nitrogen to the soil. You can improve the quality of the forage tremendously.

Our work at the Arthur Brown Hereford Ranch has been going on since 1944 and it shows that very well. We, of course, are pleased

with the fact now that the farmers themselves at the lower elevations are taking this work and putting it into operation as far as they are concerned. Last week in the "more meat per acre" tour by the Extension Service in Placer County, we stopped at the Louis Franceschi ranch four miles north of Lincoln. I wish, gentlemen, that if you have a chance, drive up there sometime, because Mr. Franceschi wanted to put in 300 acres in the fall of 1950, and we and the Extension Service talked him down to 50 acres so he'd know what he was getting into. He was so pleased with what the 50 acres did in 1950 and 1951, that last year he didn't come to anybody. He put in 300 more acres himself. That cost him between $15 and $20 an acre using a mixture of winter annual clovers, rose clover, subclovers and crimson clover with 200 pounds of single superphosphate per acre. Now, that's a lot of money to put on a range land, but he said if he wanted to buy an acre of equivalent land -- that is, it isn't worth very much -- it would cost him $100 an acre in that area. Now, with this program he was able to get from one acre what he had obtained formerly from four acres. In other words, it improved his carrying capacity four times. That's according to Louis Franceschi himself.

It is going to be a problem, of course, as to how to use this extra feed, but there is one advantage these desirable annuals as we call them have. The advantage being that they will keep on growing, especially rose clover, as long as any rains some in the spring. Now, that is not true of weedy grasses. The weedy grasses are drying up already. If we get a rain next week, it is going to leech some of the food value out of those weedy grasses that have already been cured. As far as the rose clover is concerned, if we get a rain next week, it is going to grow some more and so that it cures very well on the stalk. In addition to the carrying capacity that Mr. Franceschi had on that 50 acres last spring, he let it recover by taking the stock out the end of April and then during the summer allowed the livestock to use that in connection with irrigated pasture carried twice as many animals as it had before with the dry legume feed along with it.

Now, that, gentlemen, is research. As I say, our work is still continuing because we know that we can always do better, but what we are trying to do is learn just what constitutes our range resource so that we can improve it and get more livestock in California. Thank you.

CHAIRMAN LOWREY: Thank you. Any questions?

DR. LOVE: I might mention before I leave that we also have a circular on rose clover which also includes a statement about the winter annual legumes, the use of them, and on the last page also, six steps toward range improvement which, from a question asked earlier, the sixth step being "plan a good pest control program with special attention to gophers" because as soon as you improve the range, in come the gophers. (See Exhibit #11 attached.)

CHAIRMAN LOWREY: Thank you.

Now we will hear from Mr. J. L. Myler on the Demonstration Range Project.

MR. MYLER: Mr. Lowrey and members of the committee, my subject is brush range improvement demonstrations. At the University some two years ago, the University Range Land Utilization Committee felt that research by the University and by various other public agencies had developed a great deal of research information which was not being used as well as it might be throughout the State. They conceived a project which would be in cooperation with individual ranchers operating an economic livestock unit whereby we could cooperate with them in working out the application on a field scale of many of these research results.

Now, the ultimate aim of this project is to determine the economic feasibility of some of these things we can do in small plot tests. What we would like to end up with at the end of three, four or five years and as time goes on, our results will be more valuable but we want to know what it costs to convert brush range into good permanent grass range, how much it costs to make that conversion in dollars, and in turn, what returns we may expect in terms of dollars of livestock products sold but more particularly in pounds of livestock products. The project is far too young to be anywhere yet on that type of information, though those records are being gathered.

We have selected six ranches throughout the State representing six different brush types where we have these cooperative projects in progress. These projects range from eastern Shasta County, Humboldt County west of Garberville, Ventura County, San Diego County, and Tulare County. I think in a few years when we can come up with these cost figures that we will be able to answer many of these questions which arise as soon as the subject of conversion comes up -- does it pay? In many cases, we don't have that answer but this project hopes to arrive at that answer. We're attempting to apply the latest research results on all of these ranches. Just the last few weeks we have done some extensive airplane spraying with low volatile esters of 2-4D on chamise sprouts in San Diego County. We don't have all the answers, but we think that if this works out that as a follow-up program on chamise controlled burns, maybe chemical control has a place. We have it there on a large enough scale to tell. I think that very briefly covers our project.

CHAIRMAN LOWREY: Thank you very much. Are there any questions?

We're going to rush on to Dr. Biswell, then, and the Land Utilization Committee.

DR. BISWELL: Mr. Chairman and members of the committee. this is Harold Biswell. I teach range management and range research at the University in the Department of Forestry at Berkeley. The University has been carrying on a project with the California Department of Fish and Game on brush control and how it affects wild life population. This is a Pippin-Robinson project, and the Department of Fish and Game furnishes considerable money for this work. The work is carried on in very close cooperation with other agencies, especially those concerned with brush. Progress reports are prepared each quarter and we send these out to about 75 representatives of various agencies to keep them informed of what we are doing and also get their suggestions as to how the work might be improved. The principal

objective in these studies has been to study the effects of brush removal on game populations, especially deer. Although we have been working on brush and the effects of brush removal on game populations, we find that other people interested in other phases of land management are interested in the studies also. Cattlemen and sheepment have been very much interested in these studies because about the same principles in controlling brush for game also apply in controlling brush for livestock.

The valley farmers have expressed interest in the work -- the work we've done in effects of brush control in spring clover. Just in the past year, we've started some brush control work in the critical zone -- the fire hazard zone between ponderosa pine and brush, and I think foresters will be interested in that work especially as the work reduces fire hazard.

The work is being done mainly in Lake County and Madera County. In Lake County, on the chamise brush type, and in Madera County in woodland grass range type where brush is increased in abundance. The two areas together are fairly representative of large acreages of brush lands north of the Tehachapi Mountains. Many phases of brush control in relation to wild life populations are being studied such as controlled burning, mechanical control of brush, certain phases of chemical control. That's where we are trying to control populations of brush, get rid of some of the undesirable species and maybe favor the desirable species, reseeding, grazing management, reburning, and the effects of brush removal on spring flow.

Now, I shall very briefly present some of the results of this study. As I mentioned, most of the studies on deer populations have been made on chamise brush type in Lake County. There we found 40 to 110 deer per square mile in opened out brush where it had been opened by spot burning, but only 10 to 30 per square mile in dense heavy brush. In open brush, there were 115 to 140 fawns per 100 does, but only 60 to 85 in the heavy brush. The bucks from open brush were slightly heavier than those from dense, heavy brush. In open brush, the deer fed very heavily on grasses in February, March, April and May, but in the dense brush they were forced to feed largely on the browse plants. Opening chamise brush very definitely favors quail populations. In the open brush, we found 250 per square mile, but in the dense brush about 100 per square mile. In reseeding studies, some of the reseeded areas have yielded up to 2,000 pounds of fair dry material per acre. And, as I mentioned deer feed heavily on those grasses during those four months. Of course, that has very definite value for livestock, also. Effects of brush removal on spring flow have been somewhat variable. In one case in Madera County, the flow increased from 198 gallons per day to 486 gallons after the watershed had been burned by controlled fire. Another spring, it increased by 15 gallons after a grapevine had been cut off. On the other hand, the immediate flow of another spring was not affected by a clean burn of a watershed of five acres. However, the second year the flow did seem to be increased. In Lake County, a spring increased its flow from 31.5 gallons per day to 122 gallons after a group of willows 35 feet in diameter about the spring had been removed by hand. Now, as I mentioned, the studies of brush

control in the zone between brush and timber were started only this past year, but this is a zone where the fire hazard is very critical and our aim there is not to decrease the number of trees but to increase numbers of trees to improve conditions for game and reduce fire hazards, etc.

CHAIRMAN LOWREY: Are there any questions? Thank you very kindly, Dr. Biswell. I know there are a lot of questions if the hour weren't so terrifically late.

We will now hear from Mr. John McElroy of the Agricultural Extension Service.

MR. McELROY: Mr. Chairman, I am John McElroy, Director of Programs, the Agricultural Extension Service of the University of California. The Agricultural Extension Service is one of the three coordinate parts of the College of Agriculture. The college as a whole is concerned with research, teaching and extension. The Extension Service is responsible for bringing to the field from the University the results of scientific investigation and research and assisting ranch and farm people in the application of such information and in the spread of knowledge from all sources. The Agricultural Extension Service owns no land and, of itself, leases no land. Its activities in range improvement and range management are confined to private lands in cooperation with land owners and operators. Its contact with public lands is only incidental to its relationship with agencies in possession of such lands.

There are 50 county extension offices in the state, established by the College of Agriculture in cooperation with county governments. These offices are staffed with qualified representatives of the College who work out local educational problems with the local people. They are supported by a corps of specialists headquartered with the teaching and research divisions of the college on one or another of the campuses of the University of California.

The Extension Service is vitally interested in the encouragement and assistance to farmers in a broad program of improvement and management of range lands and related problems of feed production and feed utilization. It is concerned with the reseeding and the establishment of adapted species on native pastures and ranges and with the problems of fertilization and grazing management in many range areas.

In certain locations, such a program involves the clearance and preparation of land for reseeding or for the stimulation of native vegetation valuable as livestock feed. The Extension Service is interested in pasture and forage production and in all sources of supplemental feed. It is concerned with the improvement of livestock and in the most efficient utilization of feed in the production of meat and livestock products.

There are from 20 to 25 thousand acres of low foothill and valley lands, a part of which has been devoted to various crops in the past but much of which has always been native pasture. These areas are susceptible to improvement, through fertilization, reseeding

with better-producing varieties of grasses and legumes, and adaptable grazing practices. The Extension Service serves as the link between the research of the college and the activities of the ranchers in the improvement of these areas. Relying upon the research of the college, the Extension Service is stimulating local educational programs in cooperation with producers who are using this knowledge in reconverting this land to pastures of growing productivity and greater economic value.

There are some 10 or 12 million acres of foothill lands covered with relatively dense brush, providing little or no grazing. Practically every county extension office in the state is conducting a program planned cooperatively with the producers in those areas designed to stimulate increased range forage production. Most of this area requires clearance either for reseeding or to provide an opportunity for native vegetation to grow and produce feed. County extension personnel are assisting ranchers in the development of range clearance committees or associations with responsibility for carrying on a program of clearance, reseeding and development of management practices. It assists ranchers in obtaining and using the latest information from the research of the University and the experiences of other agencies and producers in other areas.

Extension personnel cooperate with the State Division of Forestry by acquainting farmers with the nature of the responsibilities and service of that state agency. They provide a means for local contact and, through the combination of efforts of the state division and the educational function of the Extension Service, assist farmers in the development of orderly and effective programs. With a follow-up in the encouragement of practices designed to encourage and maintain forage following the burns, the contribution of extension strengthens the move through to completion of the whole program of range improvement.

The county extension offices are the outposts of the Division of Agronomy of the College of Agriculture in the establishment and conduct of the larger demonstrational ranges and the many field-size reseeding trials and plans made possible by this division of the college.

The specialists on the Extension staff assist in these undertakings by the selection, interpretation and adaptation to practical use results of scientific research in the several fields related to range improvement and management activities, in keeping county personnel currently abreast of developing information, in assisting county personnel in planning their local activities, acting as liaison between the field and research personnel of the college, in carrying forward the information of the research divisions and bringing back to the college the problems of the field, and in cooperation with statewide agencies and organizations at the state level.

The clearance of brushland is but the initial step of preparation in a program of increased production and efficient utilization. Some 600,000 acres of land has been cleared of brush through

the efforts of ranchers with the assistance of the research, educational and service agencies of the state through the use of controlled fire, chemicals and mechanical means. On much of this land, there has been sufficient seed of desirable type forage plants in the soil to provide a good growth once the competition of brush was eliminated. In other instances, artificial reseeding has been necessary and about 120,000 acres of land have been reseeded with the encouragement of cooperating agencies and the immediate stimulation of the Extension Service.

The next step now being undertaken on the larger demonstration ranges is that of determining the better methods of grazing in view of usable feed, continued plant growth and forage maintenance. The Extension Service is concerned with the spread of the knowledge of this particular development and is beginning to seek the establishment of cooperative demonstration plots in grazing management with ranchers.

There are well over 2 million acres of alkali land subject to reclamation, improvement and management. The Extension Service working with the research divisions of the university is initiating a statewide program designed to utilize the newer knowledge in the improvement of these areas. It is evident that a part of this process must be the production of forage in the form of irrigated pasture or hay production and this must proceed other uses of this land.

There are 700,000 acres of irrigated pastures in the state. These were largely established during the past decade. New research on the part of the university has made possible the development of a statewide program of pasture management through improved irrigation, intelligent fertilization and systems of grazing which will increase and maintain the productivity of these pastures and return the greatest feed values. Pasture owners in cooperation with the university representatives in the county Extension offices and by contacts with other University personnel through these offices are shifting the irrigated pasture emphasis from that of establishment to that of management.

The production of feedstuffs is not the whole story. The utilization of native forage and supplemental feeds is a part of the story. The Agricultural Extension Service in close cooperation with the Animal Husbandry Division of the university, the California Cattlemen's Association, the California Wool Growers' Association and other interested groups and organizations are promoting by various planned educational programs and devices the improvement and selection of livestock, increased efficiency in feed utilization, the effective relationship of range and pasture with supplementary feed and management practices which will tend to increase livestock production and improve the economy of the livestock industry of the state.

The Extension Service, as a part of the university, well recognizes that the improvement and utilization of ranges must necessarily be developed in relationship to other resources, agricultural enterprises and land use practices. It, therefore, seeks a whole

program and full cooperation. The livestock population depends upon feed resources and feed resources come from ranges, pastures, hayfields and supplemental sources of feed.

In 14 counties of California, over 50 percent of the time of one farm advisor is devoted to range activities; in 23 counties from 25 to 50 percent of the time of a single farm advisor; and in only 13 counties there is less than 25 percent of one man's time. When we examine this somewhat more closely, we find the amount of time devoted to forage and livestock improvement is much greater. A large percentage of the time of the specialist staff, including the full time of one agronomist and two animal husbandmen, and a considerable portion of the time of three soil specialists, one forester, one economist, the weed control specialist, the irrigation specialist, the extension engineer, as well as members of the general staff is devoted to activities which contribute to this undertaking.

A large number of field plots are handled wholly by county extension personnel. A somewhat smaller, yet sizable number, are handled by them in cooperation with the Division of Agronomy, the California Forest and Range Experiment Station, the School of Forestry, the State Division of Forestry and other agencies and organizations. The improvement of California ranges and the improvement of those related undertakings in agricultural production represent the development of a meat production greatly in demand by an increasing population. It also represents the development of the greatest potential source of production and storage of fertility.

The combination of research, the spread of information, and the development of special services in cooperation with the ranch and farm people of this state will promote a continual improvement and refinement leading to a sound agricultural economy. The Extension Service in its activities recognizes that its program must be worked out with farmers and be geared to both the immediate and long-term needs. It also recognizes its responsibilities of cooperation and assistance in the effective field application of the many services and activities which go to make up the community of effort in forage development and good use.

ASSEMBLYMAN LINDSAY: In relation to other major crops of California, such as our cotton or something like that, do we have about the same percentage of people working on range improvement in the University in relation to the other crops?

MR. McELROY: If we take the whole picture, Mr. Lindsay, we have probably a greater percentage working on livestock and feed production.

ASSEMBLYMAN LINDSAY: That's good.

CHAIRMAN LOWREY: Thank you very much. Is there anyone else from the University?

If not, we'll move on to the United States Forest Service and Mr. Hendee, the Regional Forester, and let him call on the

people in his Division. We have to apologize for the length of this, but I don't know how we can solve it otherwise.

MR. HENDEE: Mr. Chairman and members of the committee, my name is Clare Hendee. I'm Regional Forester for the California Region of the Forest Service.

As many other people have said, this discussion subject as it relates to range covers a wide variety of conditions, so in order to make sure that we cover some one phase of it adequately, we broke the discussion topic up into its various elements and have taken the first step which we believe is site selection for forage improvement and we are going to present that as thoroughly as we could. I'd like to cover just briefly how we would like to attempt to do this. Mr. Wieslander is going to first present the soil information and cover type classification. Then we want Leon Thomas, Forest Supervisor for the Mendocino Forest to take that out on the ground and show how that applies on one of the National Forests as a representative area for the state as a whole. Could we go forward now, Mr. Wieslander, with the soil and cover type survey.

MR. WIESLANDER: The purpose of this statement is to inform you about one of the segments of the work of the California Forest and Range Experiment Station that bears on "Improvement and Management of Range Lands in California," the subject before this meeting today. I refer to the vegetation-soil inventory that the Station has completed for 3 million acres in Mendocino, Lake, and Humboldt Counties. This work was done for the State Division of Forestry under provisions of Chapter 1538, Statutes of 1947, California Legislature. Technical guidance in the soils part of the job was given by R. Earl Storie, Soil Technologist of the University of California, and R. A. Gardner, Senior Soil Correlator, U. S. Bureau of Plant Industry, Soils and Agricultural Engineering.

The objective of the project was to inventory the natural vegetative cover and underlying soil on wild lands and thus supply basic information of value in the management of wild lands for their yield of timber, forage, and water. It was believed, for example, that the information obtained would be helpful to the State Division of Forestry in planning more effective fire control, to the lumber industry in obtaining better management of forest lands, and to the livestock industry in brush eradication and range improvement work. In this statement, my remarks will be pointed mainly toward the range values of the inventory.

The vegetation and soils information from this project is more detailed than any yet gathered for wild lands. Significantly different kinds of vegetation types and soils are mapped down to a minimum area of 10 acres. The types of vegetation are classified according to species composition, age, and density of tree stands, and the total density of the combined tree and shrub cover. Whether or not the tree and shrub species are killed outright or sprout back following fire is also determined. The soils are classified by the standard soil series and by five 1-foot depth classes and are rated according to their suitability for grass and timber production. In addition, samples from the dominant soil series are

analyzed for chemical and physical properties by the University of California.

For the entire 3 million acres covered by the inventory, the classifications of soil and vegetation are divided between timber stand and vegetation-soil map sheets that are being made available for purchase. Each sheet is the size of a standard quadrangle sheet and covers about 37,000 acres at a scale of 2 inches to the mile. The timber stand maps are prepared first and contain information on vegetation that is obtained from aerial photo study. The vegetation-soil maps contain for the same areas as the timber stand maps, additional information on vegetation and soil that is obtained by field survey. Legend sheets that accompany the maps provide ratings of the soils for timber and grass production and information on the sprouting nature and browse values of the trees and shrubs shown on the maps.

For Mendocino County all the information on soils and associated vegetation is being put together in a special report, and a colored map of the upland soils in the county will soon be sent to the State Printer for distribution. Covering more than 2 million acres at a scale of 1/2-inch to the mile, this map is a new departure in soils mapping. Most maps show great detail in agricultural areas and classify the wild land soils broadly, often lumping them together as "rough, mountainous land." This new map lumps the agricultural soils in one class and shows the detailed information for the wild lands. Thirty-two soil series are shown, many of them mapped for the first time. They are combined by color legend into six groups. Groups 1 and 2 are associated with conifer timber forests, Groups 3 and 4 with grass, oak-grass, and oak vegetation, Groups 5 and 6 with chaparral.

This grouping of wild land soils has significance in brushland improvement for range use. On the chart of Figure 1 the average relative rating for grass and for timber is shown for a representative soil series from each group. The ratings for grass are relative to the very best grass growing soils of Sonoma and Marin Counties, which are rated 100 percent. The ratings for timber are relative to the very best timber soils of the Sierra Nevada which are rated 100 percent. The grass ratings were made by R. Earl Storie, Soil Technologist of the University of California. The timber ratings were determined by relating on-the-ground measurements of tree height growth with the soil classification.

On the basis of productivity ratings, the soils of groups 3 and 4, as represented by the Los Osos and Laughlin Series, are the best bets for the livestock producers in Mendocino County. This is also true on the basis of other inventory data collected. Topography is less steep, about one-third of the Los Osos and Laughlin soils having slopes under 20 percent. Only about one-fifth of the Los Osos soil area has a problem of brush removal. On the other hand, about two-thirds of the Laughlin soil area has tree and shrub vegetation varying from 20 to 100 percent density. Therefore, it is a soil of first priority in brushland improvement.

The soils of groups 1 and 2, as represented by the Hugo and Cornutt Series, are apparently better bets for the timber producer

than for the livestock producer. The Cornutt series is relatively poor for both timber and grass. It occupies only a small area in Mendocino County. Only pine species are adapted to this soil. However, the Hugo series occupies more area than any other soil in Mendocino County, and perhaps also in the North Coast Ranges. About six-tenths of the Hugo area can grow redwood forests, about 3/10 Douglas fir forests, and about 1/10 pine forests. As a whole the Hugo soil in Mendocino County can grow more lumber per acre than the soils of the west slope of the Sierra Nevada. The Hugo soils are generally steep. About 1/8 of the area has slopes under 20 percent, 5/8 has slopes ranging from 20 to 40 percent, and 1/4 has slopes over 40 percent. Very little of the Hugo soil has been successfully cleared of its tree growth or other woody vegetation that has followed timber cutting and burning. Less than 3 percent of the Hugo series was classified in the inventory as nonstocked or very openly stocked with tree and shrub growth, and 83 percent as densely stocked. Hugo soils are acid and inherently infertile. Therefore, if cleared, good productivity for grass can only be maintained by application of fertilizer. Freshly cleared Hugo soils grow grass quite well because they have been fertilized by the organic matter added to the soil by the forest growth. When this organic matter has been used up, productivity declines. This is substantiated by the experience of livestock ranchers. One rancher some 20 years ago cleared Douglas fir timber from large area of Hugo soil with the expectation that the soil would be as productive for grass as that of the adjacent natural grass land which belonged in the same soil group as Los Osos series. Today he will tell you that production is much less. The Hammond Lumber Company had a like experience with Hugo soil and long ago as a consequence gave up the idea of converting cutover redwood land to pasture.

The soils of groups 5 and 6 as represented by the Los Gatos and Maymen series are poor bets for the livestock producer from many angles. They rate low in productivity. The slopes are steep, like the slopes of Hugo series. They are largely covered by chaparral composed mainly of sprouting chamise, manzanita, and oak species. Only 2 percent of the Los Gatos and 3 percent of the Maymen areas were classified as nonstocked and very openly stocked with chaparral while 77 and 48 percent were classified as densely stocked. The Maymen soil is essentially worthless for growing usable grass, but perhaps local areas of Los Gatos soil where the slopes are less steep and the soils deeper than the average may justify brush clearing and seeding to grass.

In addition to productivity ratings, hydrological ratings of the different soils will be significant in programs of brushland improvement. Such ratings, for example, can serve as guides to selecting sites for clearing which will not be subject to severe erosion and runoff.

In Mendocino County hydrological ratings of the dominant soils are in the process of development by soil and water specialists. The basis for such ratings will be field observations and laboratory analyses of samples from the soils for their physical properties. In advance of these more specific determinations, Soil Technologist Storie of the University of California has set up some preliminary

ratings in the chart of Figure 2. In this chart he shows approximate ratings of two characteristics of the soil - Permeability and Erodibility under two conditions: (1) normal vegetation cover of the soil, and (2) normal vegetation burned.

Permeability of the soil is an expression of the rate of infiltration and flow of water through the soil. Changes in permeability can and do occur, depending upon a number of factors, such as (1) the impact of the rainfall which may compact the soil surface; (2) the nature of the soil itself and its ability to resist breakdown of particles, and (3) the degree of protection of the soil surface that is provided by the vegetation and litter cover.

Erodibility of the soil is an expression of its susceptibility to soil movement by wind, water, and gravity. Erodibility is influenced in large measure by the nature of the soil, its physical characteristics, the steepness of the slope, the intensity of rainfall, and the amount of surface protection afforded by the vegetation and litter cover.

Storie's hydrological ratings point out some significant soil behavior characteristics pertinent to brushland improvement on the six dominant soils in Mendocino County. With respect to increased runoff resulting from killing of vegetation cover by fire the amount of increase will be less for Los Osos and Laughlin soils than for the other four soils shown. This follows since permeability of these Group 3 and 4 soils is the least reduced by burning. With respect to erodibility after destruction of the vegetation, Los Osos and Hugo, for a given amount and intensity of rain, should give the least trouble and Maymen the most, followed next by Los Gatos.

The soil classification in Mendocino County will have increasing value as more is learned about these wild land soils. Part of this additional knowledge will come from field, greenhouse, and laboratory studies of wild land soils by soil scientists and specialists. However, a large part can come from local observations by technicians of the public land management agencies and by ranchers and other land owners themselves. For example, brush clearings and seeding to forage plants have and will be made on different wild land soils in the county. The vegetation-soil maps will reveal the kind and nature of the soils involved and the location and the areal extent of these soils in the county as well as in the adjacent areas mapped. In this way, local observations of the successes and failure can lead in future operations of this kind to the selection of the more promising sites and the avoidance of those sites that are least promising.

The U. S. Forest Service has undertaken a project that should add to our knowledge of wild land soils on the Upper Lake District of the Mendocino National Forest. By July of this year, this area comprising about 250,000 acres, will have been surveyed to the same specifications as the work in Mendocino County. The next speaker will tell you about Forest Service plans for using the inventory information.

MR. THOMAS: Honorable members of the Legislature, I am Leon R. Thomas, Supervisor of the Mendocino National Forest.

Mr. Wieslander has discussed the research progress in this program of improving our brushlands. The suitability or capability of the soil as a factor in the success of these projects has also been emphasized. I will briefly outline how we are using all of this research information in the management of brushlands within the Mendocino Forest.

Let me take a minute or two to outline three points to clarify the objectives of management on these government owned lands.

First: The U. S. Forest Service is charged with the responsibility of managing these lands for "the greatest good of the greatest number of people in the long run." This major objective requires that we balance the needs of the people - now and in the future - with the suitability of the soil for certain occupancy use on its suitability to support certain types of vegetation.

Inventories of the forest resources, including water, timber, forage for livestock, wildlife, minerals and the soil enable us to fully correlate their management with these needs of the people.

The second point is that of "Multiple Use." Our management of government lands is guided by the Multiple Use principle - which means that within a given area various types of use will be permitted in accordance with the needs and suitability of the site or the soil.

The third point is this: Water is recognized throughout the State of California as being a major resource derived from the forest areas. One of the fundamental purposes in the establishment of the National Forests was for the protection of the watersheds.

Since we recognize that water is of primary importance, it follows that other resources must be so managed as to protect the water resource. The Mendocino Forest includes the headwaters of such important streams as Stony Creek, Grindstone Creek, Thomes Creek, parts of Cache Creek and the Eel River. A controlled supply of pure water is needed from these drainages to help support our irrigated agricultural economy in the valleys below.

These three factors - "the greatest good for the greatest number", "multiple use", and the "primary importance of the water resource" guide us in drawing up management plans for unit areas. These plans then point the direction and will guide our management as accurately as we are now able to interpret the data.

We have always based our administration of the Forest on the best scientific information available. This has dictated the necessity for maintaining a good vegetative cover on these watershed areas. This, in the past, has meant that we protect the native vegetation.

Experiments and land management practices in various parts of the State, during the last decade or so, have shown that it is possible to convert some of the brushlands to a more desirable type for forage and still protect the value of the water resource.

Starting in 1948 the Mendocino Forest undertook to put some of these findings into practice on the Upper Lake and Stonyford Districts. Our objectives have been to use these known practices and to experiment with the new ideas and techniques. There are some 350,000 acres of brush lands within the Forest. It is growing on rough varied terrain that extends on both sides of the Coast Range at the lower elevations. About 90% of the brush species are the sprouting type consisting mostly of manzanita, scrub live oak and chamise.

The first job in a type conversion program is to effectively remove the existing native cover. We have used, and are using, controlled fire, bulldozers, discs, hand cutting and chemicals. We have also used various combinations of these methods.

Establishment of a new type cover, in our area, requires reseeding. We have been using seed of grass species that have proven themselves elsewhere in California. We have tried both fall and spring seeding, in the various prepared seed beds, by hand and by aircraft broadcasting. This has been followed by drags and rollers to cover the seed and, in some cases, by no follow-up treatment at all. We have also drilled seed in the disced areas.

A number of plots have been fertilized along with the other treatments. Nitrogen and phosphorus commercial fertilizers have been the chief ones used so far. Our results to date can be summed up in general as follows:

This is a "dry land farming" venture and the more favorable the weather for establishment and growth during the spring the better the results have been. Eliminating the weather factor we have noted:

1. The better the seed bed, the better the results. This means that cultivation has given best results so far.

2. The most successful seedings have been with Rye Grass, Harding Grass, Tall Fescue, Orchard Grass and Burnett. We have had little success with legumes to date.

3. Results have been poor, for the most part, in broadcast seeding after burns. An exception to this was on Elephant Hill where we secured a good stand of Rye Grass the second year after an aircraft broadcast seeding.

4. Native vegetation has been most effectively removed by mechanical means.

5. Sprouting of the brush after controlled fires has been consistent and reburns to kill the sprouts have been rather unsuccessful. We have had some success in reburns to kill brush seedlings.

6. Erosion has been present to some degree on all the plots. The degree of erosion has varied with the soil type, percent of slope and intensity of rainfall.

7. We have had some success with chemicals in killing mature brush.

8. The use of fertilizers - especially nitrogen - has resulted in better establishment. The effect of fertilizers has been most noticeable the first two or three years.

9. The only use of the improved areas so far has been by deer and rabbits. Deer grazing has been heavy on most of the areas. In some places they have practically eliminated the favored species.

10. The more suitable the soil to the planted species, the better the results.

It soon became apparent that the soil suitability was one of the more important factors in the success of the type conversion work. Last summer, through the services of the Forest and Range Experiment Station, we undertook to make a soil-vegetative survey of some 250,000 acres of the Forest in Lake County. The project is now being completed. The results of the survey to date have shown that we have a wide variety in soil types with a wide variation in their capability to support certain types of vegetation. The survey has shown a close correlation between soil types and the present native vegetative types.

Some of our soils in this area are capable for growing timber, some will grow grasses but other types are so shallow and poor that they support only a scattered stand of chamise. To date we have had little success in revegetating these poorer chamise soils.

As you know, soil surveys are not new to Agriculture, but their adaptation to use in our mountain areas as a guide to management is new.

My remarks have dealt with our type conversion work in these brush areas. I want to indicate, however, that we are also working on the problem of increasing the usability of the present vegetation as forage. This is a problem of producing sprouts and utilizing them. We are correlating this very closely with "the value of the watershed, and the suitability of the soil." We are using spot burns, crushing and making areas accessible. This program has been to improve deer forage so far. The limited work we have done is encouraging. There are many problems of managing these areas to sustain this new growth which must be worked out.

We are now undertaking a more intensive management program on a 17,000 acre unit on the Upper Lake District in which the data from the soil vegetation survey has been used as an important basic factor. This is really a pilot plan for coordinated management in this brushland type. The soil survey data is a guide to type conversion and brush improvement. It dictates the practices desirable on these soils and can be a guide as to damages which might occur from removal of the present cover. It enables us to confine our efforts to those areas least susceptible to deterioration and to areas most capable of producing good results.

The Fish and Game Department biologists have cooperated with us in obtaining wildlife data in this area. We have called on them heavily for information. They have concurred with us on that

part of the plan that deals with wildlife and have seen fit to make money available to us to carry out part of the program. We are using this money now in the brush conversion and wildlife habitat improvement part of the plan. We have undertaken other projects also with their cooperation during the past year.

We have learned a great deal through our close cooperation with other agencies of the government, our own Experiment Station, the University of California, private land owners, the State Department of Fish and Game and the Division of Forestry. We have a big job to do and close cooperation and free exchange of information and ideas will greatly speed up the job.

This has been a brief summary of our activities and I want to stress the importance of knowing the soils and their capability in the type conversion and brush improvement program.

The amount of area we have worked on the Mendocino to date is not large. We are learning a great deal that will be of much value in continuing the program. We want to be in a position to put this information into actual operation on the ground in a program of sound coordinated land management. This we are now doing.

I am extending an invitation that you visit the Forest and see the results of the program on the ground. We will be most happy to conduct you on a tour of these areas at your convenience.

There are a few photographs attached to this report which will illustrate some of the points I have discussed. (See Exhibit #12 attached.)

Thank you.

CHAIRMAN LOWREY: Thank you very much.

MR. HENDEE: Mr. Chairman, in the interest of saving a little time in summarizing, I think we want to bring out that this soil survey, I believe, is a noteworthy development. Dr. Storie's index is something. Lee Thomas has given you some administrative and operational information having to do with a sample National Forest area. I was going to say something about this pilot area on the Pit Soil Conservation District. That has been pretty well covered. All I'll say is that we are going ahead in cooperation with the other agencies. We have some 190,000 acres of National Forest land that we will cover along with the other agencies. Now, we fully realize that we have dealt with only one segment of a very complex range use, and we'd like to say that if at any future date the committee wanted us to present in any more detail any phase of this or any other forest or range problem, we'd be very happy to do so. If there are any questions, we'd be very happy to attempt to answer them.

CHAIRMAN LOWREY: We really appreciate your presentations.

SENATOR SUTTON: The work you are doing now is still experimental and pilot effort in this brush clearance and revegetation?

MR. HENDEE: In part, Senator Sutton, I'd say that is true. I don't think it's too much to say, however, that on part of it we have learned enough that we don't feel that it is experimental.

SENATOR SUTTON: Then, how would we project this? Would it be on the part of your agency or would it be an approach through permittees doing the work and improving areas for their own livestock expansion? We want to get down to where we're going to feed some cattle. That's what I'm getting at.

MR. HENDEE: Yes, I appreciate that particular angle. Well, I think it would have to be both. I think that's a subject we could talk about a long time, but I think you mentioned this morning something about hazard.

SENATOR SUTTON: The end is economic use.

MR. HENDEE: Yes, no doubt it will have to be both and I fully realize that we do need to work with the permittees and we do need to get some of this information on the ground and I'm sure that as time goes on, we will be able to do that on a much larger scale.

SENATOR SUTTON: I've been very much impressed with the evidence on that today. I think it is being done more cheaply. I think it was done quite reasonably from what I heard in the evidence today -- by permittees.

CHAIRMAN LOWREY: Does that complete your presentation?

MR. HENDEE: As far as we are concerned.

CHAIRMAN LOWREY: Mr. Wyckoff has something to present, I think, or is he separate from you people?

MR. HENDEE: No, sir, he is Director of the Forest and Range Experiment Station.

MR. WYCKOFF: Mr. Lowrey, I am S. M. Wyckoff, Director of the Forest Experiment Station at Berkeley. I won't add anything more, Mr. Lowrey, because we've rather compressed our presentation on account of the time, but I do want to take the opportunity to say that I think that this soils work which has been undertaken here as it has been explained to you is of very, very fundamental importance, and I hope you understand that it has been financed under a cooperative agreement with the State Division of Forestry. I think the State is to be very highly compliemented for its vision in supporting a project of this kind because I think it will be something of great importance in the future. Thank you.

CHAIRMAN LOWREY: So we are at the point now where we are getting out of the experimental stage and getting into the practical result stage. Is that not true?

MR. WYCKOFF: Yes, that's true, although we'll always go on learning more and more.

CHAIRMAN LOWREY: Oh, that's right. We are also interested at this stage of the game, at least, in getting tentative results and conclusions. I know you scientists are reluctant to draw conclusions and list results, but we're reaching the point now where it would seem -- and I hear this from the general public, they are beginning to demand, let us call it, tentative conclusions and results. We'll leave you that loophole at the end.

MR. WYCKOFF: I think the tabulation and map on the wall are pretty practical things, and they are being followed up practically by the work Mr. Thomas is doing on the Mendocino National Forest.

SENATOR SUTTON: I want all of you to realize that this is Mr. Lowrey's and my own National Forest. We're very proud of this work.

CHAIRMAN LOWREY: Also, for the record, we didn't have anything to do with instituting this program on our own ranges although we're very proud and very happy that this section was chosen in our area. In fact, we didn't know about it until it was well along. We didn't lose any time publicizing it, though, as soon as we found it was going on, I can assure you of that.

Well, now getting to these people that have waited so patiently here. I saw Mr. Jacobsen back there, and I wonder if he doesn't have something to say about noxious weeds and certified seed. I think we could well afford to have something in the record in that regard.

MR. JACOBSEN: Mr. Chairman and members of the committee. I am W. C. Jacobsen representing Mr. Brock, Director of Agriculture. I have brought Mr. Ball along to give you the detailed information with reference to weed control, seed inspection and seed certification.

I recognize appreciably the value of the committee's activity in correlating information that is abundantly available so that the several agencies can point out their phase in the development of this whole program. Our department, of necessity, has a relatively small association with it although when you can combine the efforts of the county agricultural commissioners who have local responsibilities in rodent and weed control, they form rather an important feature in the whole picture.

Our functions are regulatory and services, you understand. Our State Board of Agriculture and the Department has gone along and the commissioners in cooperating wherever there is indication of the necessity for it. We have a very sympathetic view toward the matter of utilizing some of these lands that need improvement, and if there is an opportunity to make more of them available so that we can get an expansion of livestock, that's good economics because we are not surplus in the livestock production field.

I want to point out one practical feature that I think is important in this whole business -- that's practical now -- our people in the department sparked the activity, and it is bearing fruit now. I think that in Humboldt County along about 125,000 acres has been cleaned up of Klamath weed by biological control.

It's true the University handled the mechanics of it, but we kept after it until it finally bloomed after about 20 years of effort. We're now asking them to go into the matter of gorse control. That is a weed in the coastal area that may be a problem.

I might clear up a couple of points while I'm here. The State Division of Beaches and Parks were somewhat at a loss to answer your question about diseases transmissable to humans that might be borne by rodents. Whenever there is a problem of that sort that arises where plague or relapsing fever areas involve a State Park, we get an authorization from the State Park people to proceed with our normal program there, recognizing their policy that they want little interference with the natural wild life on the area, so I hope that that can clear that point up and where there is need for rodent control. Otherwise, the county agricultural commissioners work with their people locally.

With reference to predatory animal control, while the Department of Fish and Game has a program, the Department of Agriculture in cooperation with the Fish and Wild Life has one primarily for preventing economic losses to livestock, and we have endeavored since they have come into the picture to integrate it so that there will not be duplication or overlapping. Of course, all of us even combine with the State Department of Public Health when there is an outbreak of rabies in an area, because rabies doesn't recognize just predators, it affects livestock as well.

Halogeton was mentioned. I didn't want the committee to get the idea that this meeting we had two weeks ago was the first time that anything had been done on halogeton. We started to ride herd on that when it first showed in California. I understand that Assemblyman Davis and Senator Powers talked of getting an extensive appropriation for eradication purposes. We discouraged that idea for the simple reason that our program must be to keep it corralled, if you please, and find the new spots and keep those corralled. They're trailing sheep and cattle across the Nevada-California line regularly. There are means of ingress and introduction and spread over which we would have positively no control through automobiles on the highways just carrying it in the dust or the dirt, railroads, other means, so our problem is to keep it reduced. We have aside from the Ordnance Depot at Hurlong -- there are only about 4,000 acres involved in the state as compared with a total of something like 1,600,000 in six of the other western states. In general, we want to be of assistance wherever we can in managing this program, and I think the fundamental thing is that what Mr. Ball will tell you about is basic in all things.

SENATOR SUTTON: Mr. Jacobsen, you spoke of the Park Service -- the State Parks are just as insistent on leaving the balance of nature among wild animals as the federal national parks people are?

MR. JACOBSEN: I can't speak for their policy, but I do know that we cooperate with them wherever we have a problem where wild life is involved in order that we are not contrary to any of their policies.

SENATOR SUTTON: I though that you intimated that they had a "no disturbance" policy toward wild life.

MR. JACOBSEN: Well, the reason we get in touch with them for an authorization is because we were advised a number of years ago that they wanted as little interference as possible with the natural, native wild life.

SENATOR SUTTON: I just wondered if they wanted to carry it so far as to want to breed ground squirrels.

MR. JACOBSEN: Oh, I don't think so.

MR. BALL: I'm Walter S. Ball of the Department of Agriculture. In addition to Mr. Jacobsen's comments on weeds, there are a couple of statements that I would like to make. One which has been of concern to us and one from which we have had a number of inquiries has been the poisonous plant phase of range lands and in our high range areas there are poisonous plants that have, of course, caused cattle losses, or livestock losses. We have been interested in helping wherever we could and have given advice wherever possible. There are many other weed species on range which are non-palatable species of which we are concerned. We are in hopes that through the research efforts at the University and some of the more toxic herbicides at lower cost that it might be quite possible to carry out further work in improving ranges in that manner.

The other comment that I'd like to make is that having to do with reseeding. Here today there have been a number of statements made relative to the amount of work that has been done toward improving ranges which represents large sums of money and we have had the experience of checking some of these areas that have been reseeded. We have found that there has been unpalatable plants, weeds and some rather low quality seed purchased for this reseeding. We understand why that comes about in most cases and that is that in our governmental agencies, it seems to be a practice that we have to take or do in many cases the lowest bids on some of these purchases. We always request that certain standards of quality be set up to be met by these bidders. But aside from that we do have the state law that all seed offered for sale or delivered has to be properly labeled, and anyone involved in a reseeding program most certainly should take advantage of these labeling provisions to know what they might be planting because they could very readily re-establish weeds and at the same time defeat the purposes intended.

Through our quarantine provisions, we do have inspection, also, of seed coming into certain points in the state. In this manner, we attempt to prevent the spread of some of these weeds going into the area. In this regard, there have been some very large shipments of seed from out of state which have been turned down and returned due to the fact that they contained noxious weeds.

One other point is that in some of the reseeding programs in the state, we have been asked to assist in some of the rodent control primarily the small rodents such as mice which can be quite destructive in a reseeding program. The county agricultural com-

missioners have, in many cases, cooperated. They have had years of experience in rodent control, preparing of baits, coloring of baits to protect bird life, and the entire program.

All of this, I believe, is important if we are going to spend money that is being expended to prepare seed beds, remove brush, and with the use of controlled burning, to plant high quality seed to get most out of the ranges. I believe, Mr. Lowrey, that's all that I have.

CHAIRMAN LOWREY: We certainly appreciate your remarks, and I believe it should be emphasized that we should be very, very careful in the introduction of seed that has even potential noxious or detrimental weed seeds in the plantings. I know many of us have not been careful enough in the past in putting the proper types of seeds on our plots. That isn't universally true, but even I personally perhaps am a little guilty on that score.

MR. BALL: Our experience has been throughout the state that high-priced seed is the most economical type to buy.

CHAIRMAN LOWREY: I'm beginning to learn that now.

MR. JACOBSEN: That's all we have unless there are any further questions.

CHAIRMAN LOWREY: Thank you very much.

Is Mr. Seidell still here? Well, I've apologized so many times now --

MR. SEIDELL: Mr. Chairman, Senator Sutton. Mr. name is Lee Seidell, Program Specialist, Production and Marketing Administration, United States Department of Agriculture. I have a brief prepared statement that I will gladly present to the committee for your records if you so desire.

CHAIRMAN LOWREY: That will be fine. If you would wish to make comment in addition, we'd be very happy to --

MR. SEIDELL: I might point out that the Production and Marketing Administration offers financial assistance to farmers for carrying out approved soil and water conservation practices. These practices have resulted from the research that has been carried on by other agencies and that our use of them in our program is after consultation with other agencies of the Department of Agriculture and also state agencies as well as the University of California.

STATEMENT BY MR. SEIDELL: The Production and Marketing Administration State Committee is responsible for the administration of the Agricultural Conservation Program. This program of the U. S. Department of Agriculture offers financial assistance to farmers and ranchers for performing approved soil and water conservation practices on their lands.

Although many of the practices available in the Agricultural Conservation Program are designed for and carried out on the crop lands of the State, I will attempt to confine my remarks primarily to those practices that are applicable to the range and forest lands of California. My presentation is divided into three main sections, as follows:

I. The Purpose of the Program and How It Operates
II. The Practices Available
III. Accomplishments

I. The Purpose of the Program and How It Operates

As expressed in the Secretary of Agriculture's Memorandum 1278, the basic physical objective of soil conservation activities by the U. S. Department of Agriculture agencies is the use of each acre of agricultural land within its capabilities and the treatment of each acre of agricultural land in accordance with its needs for protection and improvement.

The purpose of the Agricultural Conservation Program is to encourage and assist farmers and ranchers in accomplishing the above objectives by offering to pay part of the cost of carrying out needed conservation practices. These conservation payments, sometimes referred to as incentive payments, average less than half of the farmer's and rancher's out-of-pocket costs for carrying out the practices.

Technical assistance on many ACP practices is furnished by the Soil Conservation Service and on forestry practices by the Forest Service.

Each year the practices available in the nation are published in a National Bulletin. The practices are developed from recommendations solicited from county and State PMA committees throughout the nation and after consultation with other agencies of the Department. Within the general framework of the National Bulletin the State Committee, with the cooperation of other agencies, such as the Soil Conservation Service, Forest Service, and Agricultural Extension Service, develops a State handbook which sets forth the practices and payment rates for use in this State. In turn, each county committee, in cooperation with other agencies, selects the practices it wishes to emphasize in its county through the use of incentive payments. Each county receives a definite allocation of funds for use in making these payments. For 1952, California's allocation for practice payments is $4,807,000.

In order to qualify for a practice payment, a producer must have an approval from the PMA county committee before the practice is started. Approval is issued in writing and a definite commitment of funds is made to the practice. The producer must perform the practice in accordance with specifications and report the performance by a determined expiration date. Payments are made toward the end of the program year and during the first several months after the program year has been completed.

II. The Practices Available

The practices available in the 1952 State handbook which have been developed to improve our range and forest lands are:

A. Range Practices

1. Water developments - wells, springs, dams, pits, ponds, tanks, and pipelines for livestock water.
2. Controlled grazing.
3. Stock trails.
4. Seeding and improvement of permanent pastures.
5. Fireguards.
6. Control of competitive plants.
7. Permanent fences on grazing land.
8. Planting for seed production desirable range and pasture grasses and legumes which are in short supply.
9. Clearing land for improved pasture.
10. Sprinkler irrigation on rolling lands for irrigating permanent pasture. This is a new practice that has been added to our program. For a long time ACP payments on irrigation have been limited to reorganizing existing farm irrigation systems to conserve water. The new practice permits a payment for new installations and for portable pipe. It should help considerably to encourage the installation of irrigation systems on the foothill lands of the State whereby one acre of irrigated pasture may produce as much feed as fifteen acres are producing at the present time.

We believe that everything possible should be done to stimulate the production of livestock feed in this State. The performance of these practices is one means of increasing the production of our range lands.

B. Forestry Practices

1. Construction of firebreaks or fire lanes.
2. Planting forest trees.
3. Improving a stand of forest trees.
4. Clearing land for planting trees.

III. Accomplishments

1950 is the latest program year on which we have a complete tabulation of participation and performance in the ACP. During that year conservation payments were earned by California producers for performing, among other practices, the following:

1. 28,558 acres of land were cleared for improved pasture.

2. 122,158 acres of land were seeded to pasture.

3. 494 dams were constructed to provide livestock water.

4. Competitive plant control was carried out on 8,994 acres.

5. 524 irrigation dams were constructed.

In 1950 over 17,000 farmers and ranchers in California received conservation payments for carrying out approved soil and water conservation practices. For 1951, it appears that approximately the same volume of practices was performed. The program is applicable to privately owned lands. Participation is purely voluntary.

For the record and for the use of this committee, I wish to present a copy of our 1950 Annual Report (see Exhibit #13) and a copy of our 1952 ACP Handbook for California (see Exhibit #14).

CHAIRMAN LOWREY: Thank you very much.

Now, we asked someone from the State Engineer's Office to be here, and if these men have not stayed at this late hour, we certainly couldn't hold it against them. Is there anyone here from there? We thought we should invite you over here because in any such program, water necessarily is involved. We wanted you as an observer, and if you care to make a statement, we'd be most happy to have you make one.

MR. PIRKEY: Mr. Chairman and Senator Sutton, my name is F. Z. Pirkey, State Division of Water Resources. The area that I am most familiar with and would fit in with this meeting is the Mother Lode Section and the western slope of the Sierra Nevadas extending from Fresno River to the Feather River. It's about 200 miles long and about 100 miles wide. We classified 810,000 acres as agricultural land extending from the foothill line to the National Forest boundaries, usually it has an elevation of about 3500 to 4000 feet, and laid out projects to provide irrigation water for all those acres of which 648,000 were considered net irrigable. This would require 2,000,000 acre feet of water per year for irrigation and incidentally, there was also found about 2,000,000 kilowatts of installed capacity of hydro-electric power. The population of this area is about 125,000 and covers 11,000 square miles. It takes in about 23% of the runoff of the water of the state -- in other words, about 17,000,000 acre feet runoff from this area. The land classified was in five different classes ranging from the first class to the fifth class which took in soil a foot deep or less and slopes as high as 30%. Even this last class was considered suitable for

pasture and irrigation by sprinklers and some of it even had rocks sticking through the soil. However, it has been demonstrated that pasture can be grown on this type of land and the large number of acres classified clear up to elevation 3500 would indicate that a large amount of it would be pasture land.

SENATOR SUTTON: This 810,000 acres classified as agricultural land, what area is that generally speaking?

MR. PIRKEY: That is the Mother Lode Section from approximately Mariposa County to Butte County along the Sierras extending from the foothill line up to the National Forest boundaries.

SENATOR SUTTON: Did you go into the possibilities of irrigation water for these lands?

MR. PIRKEY: Yes, sir, we did.

SENATOR SUTTON: Did you find any?

MR. PIRKEY: Plenty. That is in the northern section, particularly. The further south you go, the less available becomes the water. However, there is sufficient water to irrigate all these acres and suitable projects have been laid out to get the water to this land.

SENATOR SUTTON: I understand in the Feather River project, the application for water is only 300,000 acre feet for that area. I've been protesting it, but I don't seem to get anyone to agree with me. They say that's double what is needed there, and I think they need about 800,000 to a million in that area. I asked if you had found out about it. I don't see how you are going to irrigate that country unless you reserve more than 300,000 acre feet from the Feather River project for the area.

MR. PIRKEY: Well, of course, the Feather River project contemplates a reservoir and a dam at Oroville which is at the foothill line, you might say, and the country I'm speaking about really extends above the foothill line and takes in most of this pasture land. That is just a good example of pasture and forest lands water development. Now, the State Division of Water Resources is investigating the entire state. It is not only that area. I gave that as an example.

SENATOR SUTTON: But just at this hearing today -- Stonyford -- we have the matter of a lower level reservoir being a barrier to anyone having any water above it.

MR. PIRKEY: I wouldn't say that, sir. The proper way --

SENATOR SUTTON: One of our witnesses, Mr. Garland, said it.

MR. PIRKEY: Well, the legal theory is that the water originating in a certain area in the state is available for the reasonable development of that area prior to anyone else using it. That has been laid down by law.

SENATOR SUTTON: I hope so. My protests then will be honored -- on Shasta dam. In the Sacramento Valley, I guess you have to dam water then.

CHAIRMAN LOWREY: I believe it is unnecessary, but so we will have it on the record, I hope that your people will cooperate with Mr. Murphy if he calls upon you for some assistance in working out the legality of that question that came up today regarding the water in the Stonyford drainage area, and I'm sure --

MR. PIRKEY: I might say a word or two on that. I didn't get the drift of that where it was a federal adjudication or a state adjudication.

CHAIRMAN LOWREY: I believe it is a federal adjudication.

MR. PIRKEY: Well, I'm not too well up on that one, then, but I can talk about state procedure, etc. I don't see where the difficulty lies particularly to build a small dam that's under six feet high requires no state permit whatever, and if the reservoir capacity is less than 50 acre feet, there is no permit required at all as far as the construction of the structure is concerned. However, the use of the water comes under our laws of appropriation the same as -- no matter what the amount is. Even a tenth of a second foot, it is necessary to make application for, or a hundredth of a second foot, and you merely make an application to appropriate water to the Division of Water Resources on a form and that is published. Anybody that feels they would be interfered with by granting that application, they put in a protest. The Division of Water Resources hears all the protests, and if there is plenty of water and nobody is being hurt by it, the application is granted.

SENATOR SUTTON: That's the kind of evidence we like to hear.

CHAIRMAN LOWREY: Thank you, Mr. Pirkey.

Is there anyone here from Farmers Home Administration? Would you care to add anything?

MR. CAMPBELL: I am Elton Campbell, State Field Representative. I don't believe I have anything to add, Mr. Lowrey. I've been sitting in mainly to see what I might learn.

CHAIRMAN LOWREY: Thank you. One of your representatives contacted me this week when we were on the tours in Northern California, and I want to apologize for not having you listed on the agenda, but I just wasn't aware that you people would be in the picture. In fact, we probably missed some others, but I hadn't thought of FHA as being interested until he described why and how you were.

Now, is there any other agency that we have missed?

MR. PERRY: Mr. Lowrey, in response to the committee's request, the Soil Conservation Service has prepared a statement on its management of public lands, but I would be happy to cooperate with the committee and the audience by filing that and letting them read it in the

record. I'm R. D. Perry of the U. S. Soil Conservation Service.

CHAIRMAN LOWREY: Thank you, and if you wish to make a formal statement, we'd be happy to have you. We certainly want to deny no one.

STATEMENT BY MR. PERRY: With the exception of a small nursery tract at Pleasanton, the Soil Conservation Service has jurisdiction of only one tract of Federal land in California.

This tract of approximately 18,000 acres is situated in Butte Valley in Siskiyou County. It was acquired during the 1930's under the submarginal land purchase program of the Bankhead-Jones Farm Tenant Act. The area had been dryland farmed, abandoned, and was tax delinquent and had reverted to sagebrush at the time of purchase.

The aims of the Government in managing these lands are to re-establish grass on the area and make it available to local ranchers on a need basis, in accordance with the basic objectives of the purchase program.

The Soil Conservation Service has reseeded approximately 2,300 acres and plans to complete the seedings in the next few years as funds are available. Crested wheat grass is the principal species being planted and excellent results have been obtained. Fencing and water development are also done, along with the reseeding program.

Grazing rights for the entire project have been leased to the Butte Valley Soil Conservation District for a period of ten years from May 1, 1950. Under this lease, the District Directors issue grazing permits to local ranchers according to the priorities established by the Government for the use of these lands. Currently, there are 15 such permits covering 362 head of cattle for 4½ months grazing season, or 1629 animal unit months annually.

Grazing fees are adjusted each year with the Directors, taking into consideration current values of grazing leases and the price of beef. Last year $1,140.30 was collected, of which $293.82 was returned to Siskiyou County and $881.48 went to the Federal Government.

The Soil Conservation District Directors and local people have indicated that they are well satisfied with the management of these lands.

CHAIRMAN LOWREY: Now, is there anyone else we might have missed? Mr. Safford, you're on the Range Advisory Board. Have you anything to say?

MR. SAFFORD: Nothing, thank you.

CHAIRMAN LOWREY: Mr. Spencer, anything more?

MR. SPENCER: Nothing.

CHAIRMAN LOWREY: Now, if anyone is here and hasn't been heard --

MR. GOVER: Mr. Lowrey and Senator Sutton, I am W. C. Gover from Anderson, California, and I haven't a thing to add to this, but I just wanted to let you know that another member of the Range Advisory Committee was here. I'm on that. I have been for several years, in fact. I am also Secretary of the Range Advisory Board for Lassen National Forest. I'm just down here to sort of listen as much as anything else, and I couldn't add anything at all to what has been said except that I might tell you that we have formed -- it's in the process of getting a committee in action in Shasta County for screening the applications for brush burning, and we kind of think maybe it is going to be successful. We are going to interview all applicants and advise them as best we can. Further than that, I'll just say thank you for letting me sit here and listen to you.

CHAIRMAN LOWREY: We're happy to have you. We also want it noted in the record that Professor Ben Madson was called away and couldn't be here today and wanted it expressed in the record that he would have been here if he hadn't been unavoidably detained otherwise.

MR. JACOBSEN: Mr. Chairman, I don't know whether this was made known to you this morning, but Acting Dean of the College of Agriculture, Dr. Stanley Freeborn, was here for most of the morning session.

CHAIRMAN LOWREY: I'm very sorry I didn't notice him or we certainly would have called on him, but we want him listed in the record as having been here. Thank you very kindly.

If there are no other statements, we will declare the meeting adjourned, and we didn't have to go until midnight on it although we did rush through. Thank you kindly for attending and your presentations.

Meeting adjourned at 6:15 p.m.

Exhibit #1

State of California - Department of Natural Resources
DIVISION OF BEACHES AND PARKS
1211 Sixteenth Street - Sacramento 14

April 11, 1952

Honorable Lloyd W. Lowrey, Chairman
Assembly Subcommittee on Public
Lands, Grazing and Forest Practices
State Capitol
Sacramento, California

Dear Mr. Lowrey:

The State Division of Beaches and Parks will be most happy to have a representative present at your joint meeting with the Senate Committee on Public Lands on May 17, at 10:00 A.M.

The subject of Range Improvement and Grazing Problems in California we feel is of great interest to the work of this Division.

Thank you for your invitation. I am

Sincerely yours,

/s/ Newton B. Drury

NEWTON B. DRURY, Chief

NBD:ECA:bhl

Exhibit #2

State of California - Department of Natural Resources
DIVISION OF BEACHES AND PARKS
1211 Sixteenth Street - Sacramento 14

April 15, 1952

Honorable Lloyd W. Lowrey, Chairman
Assembly Subcommittee on Public
Lands, Grazing and Forest Practices
State Capitol
Sacramento, California

Dear Mr. Lowrey:

I am happy to send the enclosed copies of reports in accordance with our conversation April 2, in which we discussed the subject of grazing on public lands. These reports cover individual problems but are truly representative of our policy with regards to grazing in state parks in that it demonstrates that we investigate each grazing concession individually before decisions are made. This has been our practice for some time and I am sure you can appreciate that it is our bound duty to make certain that grazing in parks is not incompatible with outdoor recreation of the public.

I regret that I must be south to a State Park Commission meeting on May 17, and therefore will be unable to attend the joint conference of yours and the Senate's Committee on Public Lands. I am having a representative of our Division to be present as an observer.

Sincerely yours,

/s/ Newton B. Drury

NEWTON B. DRURY, Chief

NBD:ECA:bhl

Enc.

Exhibit #3

August 29, 1951

Newton B. Drury, Chief

Frederick A. Meyer

Palomar Mountain State Park - Grazing Study

At the request of Deputy Chief Earl P. Hanson (Acting Chief at the time of his request), I have made a study of the grazing situation at Palomar Mountain State Park. This involved both the history, background, and objectives of the practice, and the actual conditions on the ground at the present time. My findings and recommendations are included in this memorandum.

The principal grazing lands within the park consist of 3 large meadows occupying valley-bottoms and their adjacent slopes. They are Upper Doane Valley and Lower Doane Valley, both on Doane Creek; and Lower French Valley, on French Creek just above its confluence with Doane Creek. Lower French Valley is frequently not distinguished from Lower Doane Valley in local practice; since the two are joined by a strip of meadow across a low divide; but actually the two are distinct valleys on separate streams, lying in the pattern of a V.

Seasonal grazing has been carried on in the meadows of what is now Palomar Mountain State Park over a long period of years. Prior to the establishment of the park, overgrazing was common and sometimes severe, and the meadows suffered accordingly. This factor, combined with weather conditions, brought about the start of the gullies which now lace the meadows. One local resident told me the gullies developed as a result of heavy rains in the year 1916. Following the acquisition of the Park area by the State in 1932, the gully erosion was arrested by control work performed by the Civilian Conservation Corps, and grazing practices were brought under some degree of control through the issuance by the State Park Commission of a lease to a single party annually. A succession of years of good rainfall aided further in the restabilization and partial healing of the erosion scars. But beginning in 1946 and continuing through the present time, Southern California has been experiencing a very severe drought. The water table at the Palomar meadows has dropped markedly; the cattle have altered their grazing habits and areas of concentration to some extent; some of the CCC check-dams have washed out or collapsed; and the net result has been a return to conditions of deterioration of the meadows.

Mr. Arthur Stone of Mesa Grande, California, has obtained the annual grazing permit from the Park Commission each year except two since the establishment of the park, and also had stock in the area during seasons prior to that time. Grazing in the park was suspended for the season of 1935 during the construction of erosion control facilities by the CCC and the replanting of eroded areas. In 1943 the grazing was issued to the California Institution for Men, a State correctional institution located at Chino. In my opinion the State has been very fortunate in having a permittee as cooperative as Mr. Stone. Even when not required to do so under the stipulations of his written permit, he has generally followed reasonable range management practices in the handling of his

stock (including voluntary reductions), and has avoided most practices which might have resulted in some immediate benefit to himself but would have been to the serious detriment of the range.

In 1933, the first season after the park was created, the fee for the grazing permit was set at $450, although in one early year some $200 was remitted to cover the cost of fencing done by the permittee. Lands described as included in the permit area embraced 1640 acres, or all except 40 of the entire park area, "except developed campgrounds and springs". The term of the permit covered a full year. In 1939 the area included in the permit was reduced to the 640 acres (less the same exceptions) still embraced at the present time. At the request of District Superintendent Guy Fleming, the term was changed to April 1 - November 30, in order to conform more nearly to the actual grazing season and the avoid the precedent of appearing to encourage grazing during the off-season when it would destroy the range. The next year, in 1940 the fee was raised to $750, and a stipulation was added providing that the Commission might "regulate and control the pasturage of livestock upon said lands, and the places where, and the times when, such pasturage may be had..." In 1941 the permit was issued after competitive bid, and Mr. Stone obtained it for $1000. In 1944 he successfully bid $1200 for the privilege; and in the same year the limitation of 125 head of stock appeared for the first time as a stipulation in the permit, although it had previously been in effect through understanding between the permittee and district superintendent Fleming, perhaps under the clause added in 1940. The 1951 permit has been rewritten in much more legalistic form, although there is no essential difference in the stipulations other than that the dates have once again been set on a full annual basis, from December 1 (1950) to November 30. From the range management standpoint the latter is a definite step backward, unless specific steps are taken to control the permittee's activities under the terms of the clause added in 1940 and quoted above.

In examining the grazing allotment this season, I found on April 27, that the grasses and other forage plants in the meadows had not yet attained their mature size. Only the uppermost edges where the soil would dry out earliest were the grasses beginning to form heads. It appeared that the proper time to start grazing would be about May 15 or 20. But the cattle had already been brought into the area, - on April 1 in the upper meadow and April 23 in the lower ones. Water was flowing in the streams, and the muddy banks of the gullies were being badly cut up by the cattle going up and down in various places.

On July 24 I was amazed at the changes that had taken place since my previous visit. The general appearance of the meadows was not unlike that in the Spring; but closer inspection showed that almost every vestige of grasses and other forage plants has already been consumed, and the remaining vegetation consisted of sedges and other plants which have little or no forage value. Doane Creek was dry except for a few stagnant pools. A springy area on the south side of the upper Valley was very seriously trampled, and in this area the cattle had been browsing on non-forage plants, including even some young white fir trees, which had been practically stripped of foliage. The permittee had voluntarily been grazing only 100 head of cattle, instead of the allowed 125, and two weeks previously had removed and sold all but 36 animals.

When we drove into Lower French Valley in the park jeep, and cattle immediately came toward the car. I commented on this unusual behavior of the animals, and RangerHaussler explained that the permittee had been bringing in hay and cottonseed meal for them because of the depletion of range forage. There were at least 14 outside cattle trespassing in the park, thus indicating the need for additional fencing.

The written permit, in stating the benefits to be obtained by the State from the grazing of cattle, mentions only the reduction of fire hazard through the removal of grass, weeds, etc. I have given considerable thought to this premise, and have concluded that it is based on an inaccurate conception of the real nature of fire danger at Palomar Mountain. The human agencies likely to cause fire within the park are located primarily along the roads and in the campgrounds. Even were there no cattle or fences, the meadows would not be of great importance from the standpoint of fire origin. But because a primary fire lookout is located on Baucher Hill within the park, offering excellent coverage of the whole park area, the probability is very great that any fire starting within the park would be discovered almost immediately, reached very promptly, and controlled before it had done any serious damage. The major element of fire danger at Palomar Mountain is from the possibility of an outside fire sweeping up the steep slopes and into or across the park on a relatively wide front. It is safe to say that in the event of such an occurrence, the condition of the meadow area, grazed or ungrazed, would be of no practical consequence whatever. In a letter dated February 13, 1951, to Park Ranger John Fleming, then in charge at Palomar Mountain, Mr. E. W. Shultz, then District Ranger and now Fire Control Officer of the Cleveland National Forest, states that the United States Forest Service considers the valley areas on Palomar Mountain to be of a very low hazard type, and that they contain a fuel type of relatively low inflammability. In view of these considerations, I am unable to conclude that grazing reduces the fire danger to any material extent, or that any possible reduction so obtained is of any practical significance.

On the other side of the ledger, it appears that the grazing of cattle in this park may have some definitely detrimental aspects. District Superintendent Kenyon has already recommended the discontinuance of grazing at Palomar Mountain on the grounds that it interferes with the recreational use of the park. Ranger Haussler states that the campers complain of flies. The directors of the San Diego City - County Camp have indicated to Mr. Kenyon that the presence of the cattle interferes with their activities. From the more esthetic point of view, it is worth noting that the Palomar meadows are extremely beautiful and inviting; but that the presence close to the camping areas of barbed wire fences, and of cattle of unknown disposition, offers deterrents to the visitor that seem somewhat inappropriate within a State Park. The present effects of the grazing on erosion conditions and on plant life have already been mentioned.

CONCLUSIONS

1. It is my recommendation that grazing at Palomar Mountain State Park be completely eliminated, for the following reasons:

(a) It fails effectively to accomplish the only purpose which has been put forward to justify it, - i.e., reduction of the fire hazard. This leaves the cash income as the only distinct benefit to the State.

(b) It interferes in several ways with recreational activities which are the primary purpose of the park.

(c) It is once again causing gully erosion to spread in the meadows.

(c) It is maintaining unnatural conditions of plant life and growth in an area where natural conditions are desirable.

2. If the complete elimination of grazing in this park be disallowed, then I urge that grazing be suspended for the duration of the current drought and for two or three years thereafter, in order to allow the meadows to recover and to give time for some repair of the erosion damage. I further recommend that when grazing is resumed, the opening and closing dates be carefully set each year on the basis of the actual condition of the range, and that the number of cattle permitted be carefully adjusted also, probably at a figure considerably below the 125 allowed at present.

FREDERICK A. MEYER
Forest Technician

FAM:rk

cc: Deputy Chief
Lands Section
District Supt. (2)

Exhibit #4

October 5, 1951

Newton B. Drury, Chief

Frederick A. Meyer

Cuyamaca Rancho - Grazing Conditions

During the present 1951 season I have visited Cuyamaca Rancho State Park on two different occasions. The first was from April 25 to May 1, and the second on July 24 and 25. My observations of grazing and the conditions resulting therefrom entirely corroborate those of District Superintendent W. L. Kenyon, as expressed in his letter of September 25 to the Lands Section.

On the occasion of my April visit, the cattle had been in the park long enough to reduce the height of the forage grasses to about half the height of that growing on roadside areas fenced from the animals. At that time it appeared to be still too early, by several weeks, for grazing to start, on the basis of the maturity of the plants and the condition of the ground. In July, theoretically only midseason, the forage was already very seriously depleted in all the park lowlands, although there were some remote areas that had been grazed little or none, largely because of their remoteness from water.

The practical irrelevance between grazing and fire control in the Southern California mountains is excellently illustrated by the conditions at Cuyamaca with relation to the disastrous Conejos fire of August, 1950. Although the park had been heavily grazed for years, this factor afforded no protection whatever in a major fire situation. As far as fires originating within the park are concerned, the degree of protection already afforded us by the primary lookout on Cuyamaca Peak, combined with the Division of Forestry fire station at Paso Picacho, is so great, in my opinion, as to make the doubtful contribution of livestock grazing not worth its high cost in terms of other consideration.

The situation at Cuyamaca as I see it is entirely comparable to that at Palomar Mountain, upon which I reported to you under date of August 29, 1951. In its relation to recreational activities, erosion and plant growth, as well as in its lack of correlation with fire control, my conclusion is the same for Cuyamaca as for Palomar and my recommendation is the same. I believe that grazing within the park should be terminated at the earliest practicable date.

FREDERICK A. MEYER
Forest Technician

FAM:lh
cc: District VI (2)
Lands Section

Exhibit #5

March 19th, 1952

Newton B. Drury - Chief

Frederick A. Meyer - Forest Technician

Cuyamaca Rancho - Reforestation and Grazing

The present situation at Cuyamaca makes desirable a rather unusual degree of correlation in the planning of some of our usual activities. The results of the fire of August, 1950, and particularly our desire to allow the scars of this fire to heal as rapidly as possible, require that these considerations receive priority over other factors if the recovery of the park is not to be delayed.

As you know, natural reproduction of several tree species has started locally in parts of the burned area; and it is expected that seedlings of additional species will start when those species have their periodic seed years. The present wet winter should be an important factor in helping these seedlings become established. As you also know, we are planning to supplement this natural regeneration with artificial reforestation of the native species, in a subsequent year, as the need is revealed by examination. The Division of Forestry at the present time, with our cooperation, is conducting experimental planting of both seed and seedlings to determine the type of planting which should be employed for the different native species at different elevations and exposures within the burned area.

In helping to assure that the young trees become established and survive the competition of the chaparral species, control of grazing is one of the most important factors. The ideal situation would be the elimination of grazing entirely, as I have previously recommended on its own merits. If this is not possible, it is then very important that the grazing permittee be required to control his animals adequately, both by proper salting practices and by riding and herding; to keep them out of the areas where the young trees are growing.

Forest regeneration at Cuyamaca, both natural and artificial, is going to need all the help we can give it if the burned trees are not to be succeeded by brush and chaparral.

FREDERICK A. MEYER
Forest Technician

FAM:re

Exhibit #6

APRIL 1, 1952

GRAZING CONCESSION	REVENUE	TERM	EXPIRATION DATE	ACREAGE
Bailey Brothers Borrego State Park	$810.00 - for term thereof	3/1/51 ending 11/30/52	11/30/52	Approx. 12,720
Joseph Denni Anza Desert State Park	$80.00 for term	1 year	3/31/53	1,920
J. I. Elliott Anza Desert State Park	4/1/52 $44.00 10/1/52 $44.75 $88.75	1 year	3/1/52 ending 2/28/53	2,840
Mrs. Genevieve Fuquay Anza Desert State Park	$55.00 - per year Total $165.00	3 years	7/1/49 ending 6/30/52	1,760 more or less
Ralph Jasper Anza Desert State Park	$906.25 for term thereof	1 year	1/1/52 ending 12/31/52	Approx. 29,000
Clarence Littlefield Trinidad Beach State Park	$25.00 - for term thereof	1 year only	5/1/51 ending 4/30/52	21
Charles Luckman Anza Desert State Park	$424.00 payable upon execution of agreement and; 1/1/50; 1/1/51; 1/1/52; 1/1/53	5 years	1/1/49 ending 12/31/53	10,420

Exhibit #6

GRAZING CONCESSION	REVENUE	TERM	EXPIRATION DATE	ACREAGE
Richard M. McCain Anza Desert State Park	$20.00 per section per year. 3½ sections. Total $70.00	1 year	10/1/51 ending 9/30/52	2,240
Dr. James E. McConnell Columbia Historic State Park	$255.00 upon execution of agreement and at beginning of any additional year period	1 year with option of renewal for a 4 year period	1/1/51 ending 12/31/51 Using option ending 12/31/55	Approx. 82
Benjamin J. Pack Humboldt Redwoods State Park	$240.00 per year	1 year	9/1/51 ending 8/31/52	Approx. 20
Miriam Rudisill Del Norte Coast Redwoods State Park	$75.00 for term thereof	1 year	2/1/52 ending 1/31/53	400
Emily E. Sawday Anza Desert State Park	$81.70 for term thereof	1 year	1/1/52 ending 12/31/52	Approx. 2582.52
Boyd Stewart Samuel P. Taylor State Park	$1525.00 annually payable on execution of agreement thereafter 1st day of each May	5 years	5/1/50 ending 4/30/55	940 more or less

Exhibit #6

GRAZING CONCESSION	REVENUE	TERM	EXPIRATION DATE	ACREAGE
Arthur Stone Palomar Mt. State Park	$1200.00 $600.00 upon execution of agreement $600.00 on or before May 1, 1952	1 year	12/1/50 ending 11/30/51 and now renewed for 12/1/51 ending 11/30/52	640 more or less

Exhibit #7

(COPY)

CALIFORNIA WOOL GROWERS ASSOCIATION

151 Mission St. San Francisco, 5

March 8, 1952

Mr. Newton B. Drury, Director
California Division of Beaches and Parks
Department of Natural Resources
Sacramento, California

Dear Mr. Drury:

Mr. Newlin met us at Rock City, Mt. Diablo State Park. We took the liberty of requesting that Dr. H. H. Biswell, School of Forestry, University of California, Berkeley, accompany our group which consisted of Lee Higgins of Antioch, Bob Foskett and Bill Foskett (who previously grazed sheep on the Park) also J. Kenneth Sexton of Willows, former president, California Wool Growers Association, and now vice-president, California Cattlemen's Association. W. K. Davis, Asst. Ranger, and R. F. Bassett, Chief Ranger, were there.

Attached is copy of Dr. Biswell's report.

Dr. Biswell now is leader of a joint project SURVEYS AND INVESTIGATIONS as required by FEDERAL AID IN WILDLIFE RESTORATION ACT, title of project: Effects of Brush Removal on Game Ranges in California. Bureau of Game Conservation, California Department of Fish and Game with University of California cooperating.

The project embraces studies of wildlife, plant succession and season of brush removal, investigations of browse growth and utilization.

Dr. Biswell states, "....Of course, we must look upon this area as one purchased and managed primarily for recreation. Many people go there during the weekends for picknicking and camping. In spite of this, however, I would recommend that the area below Rocky Point be grazed moderately by domestic livestock, either sheep or cattle. The primary reason for grazing would be to reduce the fuel and fire hazard....."

In view of Dr. Biswell's report and in behalf of Mr. Wm. W. Foskett, Jr., 218 Carmel Ave., Piedmont, California, we shall appreciate if grazing by domestic livestock may be permitted under lease by Mr. Foskett on those areas of Mt. Diablo State Park as suggested by Dr. Biswell.

Sincerely yours,

(Signed) W. P. Wing
Secretary

Exhibit #8

Department of Natural Resources
DIVISION OF FISH AND GAME
Ferry Building, San Francisco

DEER MANAGEMENT POLICY FOR CALIFORNIA
Adopted by the Fish and Game Commission June 27, 1950

The following statement outlines some of the primary objectives of the Fish and Game Commission in the management of deer.

1. To produce and maintain a maximum breeding stock of deer on all wild lands of California, public and private, consistent with other uses of such lands, and to utilize, through public hunting, the available crop of deer produced annually by this breeding stock.

2. To maintain for deer the best possible range conditions in conformance with other interests and uses; to expend funds for the improvement of deer ranges wherever such ranges are open to public hunting, and to aid and encourage private landowners to improve their deer ranges even though hunting is limited.

3. To keep deer populations in balance with local forage supplies and conflicting uses.

4. To assure a carryover of a maximum breeding stock of deer consistent with the forage available on each local unit of range.

5. To permit the harvest of all surplus animals, of either sex, over and beyond what the range can carry in healthy condition.

6. To limit the acquisition by the State of deer lands, access roads thereto or rights-of-way to those cases where unusual benefits will derive from the expenditure of moderate sums.

7. To control populations of deer that are rendering appreciable damage to valuable crops, orchards, vineyards or gardens, by regulated public hunting where possible; elsewhere permit shooting will be relied upon.

8. To work out with other interested parties an equitable allocation of forage for deer and livestock where conflict or competition exists, and thereafter to regulate the deer herd according to such agreements.

9. To give primary consideration to deer in allocation of forage where the demands of deer and other big game species, native or introduced, may conflict.

10. To manage deer herds on the basis of natural forage without recourse to artificial feeding.

11. To re-open to deer hunting, following prescribed legal procedures, such existing refuges as are not actually needed to protect depleted herds, and when need for special local protection arises, to close such areas temporarily.

12. To hold local public hearings in any area where the Commission intends to apply deer herd management regulations. Notice of such hearings will be given in papers of local distribution. The opinions of local groups of sportsmen, ranchers, and other interested parties will be heard and given consideration before final adoption of rules and regulations for any special hunt for deer.

13. To regulate the numbers of deer predators on the basis of local deer needs concentrating control efforts on under-stocked ranges or ranges where hunters are fully harvesting the annual deer crop.

14. To make impartial objective surveys of the deer herds annually in order that the Commission may be supplied with authentic information for its guidance in establishing hunting regulations and planning other aspects of deer management.

15. To inform the public concerning the mechanics of deer management and the requirements to maintain healthy and productive herds.

7-6-50 : 2000

AN ESTIMATE OF DEER HERD NUMBERS PRESENT IN THE PROPOSED REGIONAL DISTRICTS OF THE DEPARTMENT OF FISH AND GAME.

(Estimates Based on Game Bulletin #6)

I. NORTHERN REGION

(Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen and Tehama Counties)

Herd Unit	Estimated Numbers
1A Smith River	3,000
1B Happy Camp	4,000
2A Hamburg	6,000
2B Scott Valley	18,000
3A Arcata	7,000
3B Mad River	17,000
3C Eel River	17,000
4A Hoopa	1,000
4B New River	8,000
4C Weaverville	15,000
4D Hayfork	9,000
5A Alder Springs (N 1/2)	17,000
5D Paskenta (N 1/2)	2,500
6A Kings Peak (N 1/2)	1,500
8A McCloud	18,000
8B Whitmore	4,000
9A Tehama (N 2/3)	26,000
15A Copco	2,000
15B Bogus Mountain	4,000
15C Miller Mountain	9,000
15D Mt. Dome	5,000
16A Glass Mountain	7,000
16B Bryant Mountain	1,000
16C Interstate	15,000
16D Pit River Rims	7,000
17A West Warners	13,000
17B East Warners	9,000
18A Day	9,000
18B Lake Britton	3,000
18C Hat Creek	15,000
19 Eagle Lake	16,000
20A Doyle (1.2)	7,500
TOTAL FOR DISTRICT	296,500
PERCENTAGE OF TOTAL	26.4%

AN ESTIMATE OF DEER HERD NUMBERS IN THE PROPOSED REGIONAL DISTRICTS
(Continued)

II. SACRAMENTO REGION

(Glenn, Butte, Plumas, Colusa, Sutter, Solano, Yuba, Nevada, Yolo, Sacramento, Sierra, Eldorado, Placer, San Joaquin, Amador, Calaveras, and Alpine Counties)

Herd Unit	Estimated Numbers
5D Paskenta (S 1/2)	2,500
7B Monticello (E 1/2)	13,000
9A Tehama (S 1/3)	13,000
10A Bucks Mountain	7,000
10B Mooretown	4,000
10C Slat	11,000
10D Downieville	9,000
10E Nevada City	4,000
10F Camp Beale	10,000
11A Blue Canyon	8,000
11B Pacific	8,000
11C Grizzly Flats	4,000
11D Placerville	13,000
20A Doyle (W 1/2)	7,500
20B Loyalton Truckee	23,000
21A Carson River	7,000
TOTAL FOR DISTRICT	144,000
PERCENTAGE OF TOTAL	12.8%

AN ESTIMATE OF DEER HERD NUMBERS IN THE PROPOSED REGIONAL DISTRICTS
(Continued)

III. BAY REGION

(Mendocino, Sonoma, Lake, Napa, Marin, San Francisco, Contra Costa, Alameda, San Mateo, Santa Clara, Santa Crus, San Benito, Monterey, and San Luis Obispo Counties)

Herd Unit	Estimated Numbers
5A Alder Springs (S 1/2)	18,000
5B Covelo	24,000
5C Lake Pillsbury	17,000
6A Kings Peak (S 1/2)	1,500
6B Noyo River	5,000
6C Navarro River	18,000
7A Clear Lake	26,000
7B Monticello (W 1/2)	13,000
7C Santa Rosa	26,000
7D Petaluma	18,000
23A Santa Cruz	9,000
23B Mt. Diablo	8,000
23C Mt. Hamilton (W 2/3)	18,000
24A Carmel River	14,000
24B Jolon	19,000
24C Adelaida	11,000
25A Gabilan	7,000
25B Tres Pinos (W 2/3)	10,000
25C New Idria (W 2/3)	12,000
25D Bitterwater	7,000
25E Parkfield (W 2/3	2,500
26A Arroyo Grande	3,000
26B La Panza	8,000
26C Shandon (W 2/3)	2,500
26D Temblor	1,000
TOTAL FOR DISTRICT	298,500
PERCENTAGE OF TOTAL	26.6%

AN ESTIMATE OF DEER HERD NUMBERS IN THE PROPOSED REGIONAL DISTRICTS
(Continued)

IV. SAN JOAQUIN REGION

(Stanislaus, Tuolumne, Merced, Mariposa, Madera, Fresno, Kings, Tulare, and Kern Counties)

Herd Unit	Estimated Numbers
12A Salt Springs	9,000
12B Railroad Flat	7,000
12C Stanislaus River	17,000
12D Tuolumne River	16,000
12E Yosemite	15,000
12F Sonora	7,000
13A Oakhurst	8,000
13B San Joaquin River	14,000
13C Huntington Lake	5,000
13D North Kings River	17,000
13E Friant	1,000
14A Hume	10,000
14B Kaweah River	12,000
14C Tule River	4,000
14D Greenhorn	5,000
14E Kern River	11,000
14F Porterville	3,000
23C Mt. Hamilton (E 1/3)	6,000
25B Tres Pinos (E 1/3)	4,000
25C New Idria (E 1/3)	7,000
25E Parkfield (E 1/3)	1,500
26C Shandon (E 1/3)	1,500
27C Mt. Pinos (N 1/4)	3,000
28A Piute Mts.	3,000
28B Tejon	3,000
TOTAL FOR DISTRICT	190,000
PERCENTAGE OF TOTAL	16.9%

AN ESTIMATE OF DEER HERD NUMBERS IN THE PROPOSED REGIONAL DISTRICTS
(Continued)

V. SOUTHERN REGION

(Mono, Inyo, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, San Diego, and Imperial Counties)

Herd Unit	Estimated Numbers
21B Walker River	15,000
21C Mono Lake	11,000
22A Casa Diablo	6,000
22B Bishop	19,000
23C Monache	14,000
24D White Mts.	1,000
27A Lompoc	10,000
27B San Rafael Mts.	11,000
27C Mt. Pinos (S 3/4)	10,000
27D Ventura	6,000
27E Santa Monica	10,000
28C Newhall	10,000
29A San Gabriel Mts.	14,000
29B San Bernardino Mts.	9,000
29C Little San Bernardino Mts.	100
30A Santa Ana Mts.	6,000
30B Perris	300
30C San Jacinto Mts.	11,000
30D Escondido	4,000
30E Palomar	3,000
30F San Ysidro Mts.	4,000
30G Santa Rosa Mts.	3,000
30H Laguna Mts.	15,000
31A Providence Mts.	200
31B Imperial	1,500
TOTAL FOR DISTRICT	194,100
PERCENTAGE OF TOTAL	17.3%
TOTAL FOR STATE	1,123,000

A Publication of the

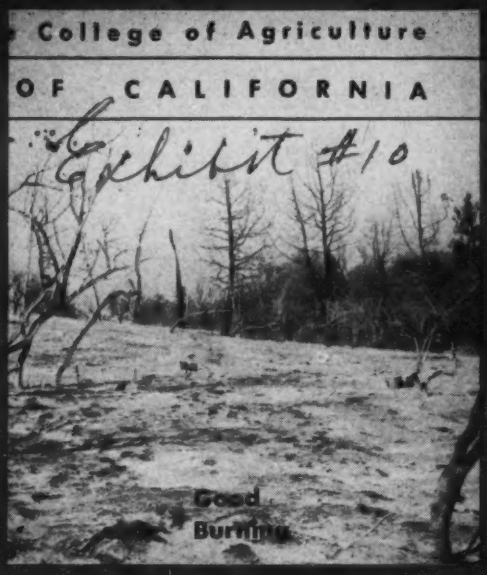
UNIVERSITY

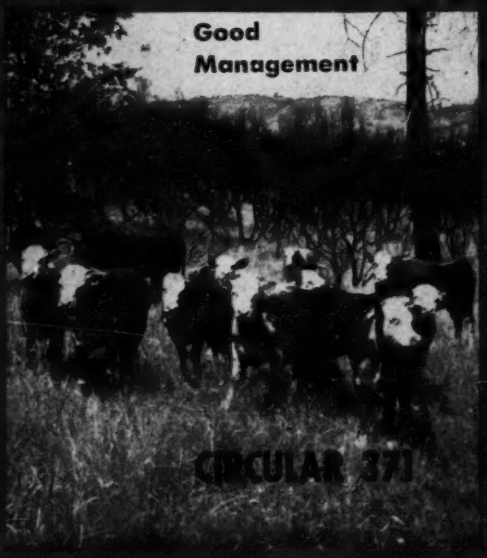
College of Agriculture

OF CALIFORNIA

Exhibit #10

IMPROVING CALIFORNIA BRUSH RANGES





Revised by

MERTON LOVE

DORMAN C. SUMNER

VICTOR P. OSTERLI

CALIFORNIA AGRICULTURAL EXPERIMENT STATION

CIRCULAR 371

MORE MEAT and MORE WOOL . . .

have been produced in California on some brushlands that have been cleared and converted into pasturage for cattle and sheep.

There are between 10 and 20 million acres of brushland in this state. While not all of this land can be cleared profitably, large areas of it will repay the time and money spent on such a project by providing support for additional stock.

In 1950, ranchers in 30 counties cleared 97,000 acres by controlled burning of brush.

A GOOD BRUSH-CLEARANCE PROGRAM . . .

must be well planned if it is to succeed. This circular will help you choose and carry out the best program for your land, through these basic steps:

1. Removal of brush. This may be done by fire alone or by mechanical or chemical methods followed by fire.
2. Revegetation of cleared areas. Artificial seeding may be necessary in some sections.
3. Control of grazing. This requires the planning of a long-term grazing program.

SINCE 1947, WHEN THIS CIRCULAR FIRST APPEARED . . .

an important trend has become apparent in the range-improvement program. More adaptable species are being seeded, and there is a better follow-up of reburning. This is resulting in a more definite and permanent conversion from brushland to grassland.

In addition, seed of new range species has now become available commercially, at reasonable prices.

Revised January, 1952

The Authors:

Mr. Love is Professor of Agronomy and Agronomist in the Experiment Station, Davis.
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Mr. Jones is Associate Agriculturist and Assistant Professor of Agricultural Extension, Emeritus.

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IMPROVING CALIFORNIA BRUSH RANGES

WELL-PLANNED PROGRAMS of brush removal by individual ranchers can change certain adaptable California brushlands into valuable grasslands that produce greater crops of meat and wool.

The removal of brush is merely the first step in any sound, long-term, range-improvement plan. Just as important, if the program is to be worth the stockman's time and money, are:

1. Seeding of cleared lands with forage grasses and legumes (when natural growth is not enough to provide pasturage).
2. Planned range management, to prevent ill-timed grazing or overgrazing.
3. Continued action to suppress the brush, by reburning or use of chemicals.

Each year, between 50,000 and 100,000 acres in California are burned over to destroy the brush. In 1950, brush was burned, under permits from the State Division of Forestry, by individuals or groups of ranchers in 30 counties.[1] The territory included about 97,000 acres with widely varying conditions of elevation, soil, brush species, and rainfall, thus indicating the wide interest in this phase of range improvement.

This circular considers the three general steps of a range-improvement program: (1) removal of brush; (2) revegetation of cleared areas; (3) control of grazing.

STEP 1: REMOVAL OF BRUSH

The first phase in a brush-removal program involves the following:

1. Choice of suitable areas where soil fertility, topography, and rainfall offer support for forage growth on cleared lands.
2. Proper clearing of the land: by fire alone on rough, steep slopes; or through use of machinery to knock down the brush, followed by fire on less steep sites.
3. Reburning of cleared lands in from two to five years to keep the brush from covering the areas again, or use of chemicals to kill the sprouts and seedlings.

Where It Pays to Remove Brush

In 1946, according to Forest Service data, California had from 10 to 20 million acres of chaparral and wooded grasslands that included large areas of little or no value for stock grazing. Some of that acreage has already been converted to pasture, but not all brushlands can be profitably cleared. Many areas are too rough and steep to be cleared, or have insufficient fertility and rainfall to support forage crops even if brush were to be removed.

Choosing the Area. Soil, topography, and brush type are the most important factors in determining whether to remove brush from a given area. The rancher's decision to clear brush should be based upon a thorough examination of the area.

Dense stands of tall brush usually indicate a moderately fertile soil capable of supporting a grass cover. If pasturable plants are found as remnants in the brush,

[1] Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Humboldt, Kern, Kings, Lake, Madera, Mariposa, Mendocino, Monterey, Napa, Nevada, Placer, Riverside, San Diego, San Luis Obispo, Santa Clara, Shasta, Siskiyou, Sonoma, Stanislaus, Tehama, Tulare, Tuolumne, Yolo, Yuba.

or if they are growing well in the open spaces, then the entire area is likely to have equal value for producing feed if cleared. (See table 4, p. 31, for types of forage plants.) Perhaps enough seed of perennials and desirable annuals is present so that artificial seeding will be unnecessary. If there is little or no grass within the area, natural revegetation may not be adequate the first winter after the brush is removed, and seeding should therefore be planned.

A given area may include shallow, sterile soils on one slope and deeper, fertile soils on another. Since it is not always economical to clear only the favorable spots, the over-all picture must be considered in choosing lands for range improvement—balancing the probable total gain in feed resources against the cost of improvement and the possible damage by soil erosion following brush removal.

Good Removal Requires Good Methods

Brushland is cleared in four ways: by fire alone, by mechanical equipment, by a combination of the two, or by chemicals.

If the land is rough or steep, it is usually cleared by the cheapest method—fire alone. Good soils and arable land justify the costlier method of using mechanical equipment to uproot the brush before it is destroyed by fire. This is preferable because brush is destroyed more completely by fire when mechanical equipment has been used first. It must be noted, however, that any disturbance of the soil may lead to erosion damage.

This brush-removal project is achieving results through careful, progressive, coöperative planning, thus winning public approval and legal and financial support. Community, county, and state coöperation is demonstrating that such a program can be carried on efficiently without threat to public safety and property rights.

Size of Area to Be Burned. Areas in any one burn have varied in size from less than 40 acres to more than 10,000. The program has now continued long enough so that burn sizes can be evaluated.

The aim should be to complete the burn in one day. This is the primary consideration as far as the effectiveness of the burn is concerned. A night fire creeps slowly and does not burn hotly enough to destroy the brush.

From the over-all standpoint, it should be determined whether the grazing periods on the newly seeded areas can be properly adjusted by the rancher. He must bear in mind that all stock should be kept off the seeded areas until the plants mature seed.

A third consideration is the cost per acre of putting in fire lines. Obviously this is less when natural boundaries, such as roads and streams, can be used. It is also usually less when larger acreages are involved.

A fourth point to be considered is the cost of seeding the burned area. This is important to the final success of the operation since it appears unwise to burn an acreage larger than will be seeded.

Smaller burns usually result in better control of sprouts and seedlings by deer.

The 100 million acres of land in California are divided roughly as follows:

	Million acres
Agricultural, industrial, and urban	14
Forest and wild land:	
Desert and barren	25
Brush	10
Sagebrush	7
Grass	10
Woodland-grass	10
Noncommercial timber	7
Timber	17
	100

Therefore, the size of the local deer population should be taken into account if this type of control is desired.

Use of Fire Alone. When the rancher has determined that fire alone is to be used to clear a chosen area, he must plan the operation carefully. Details should be worked out in accordance with requirements and suggestions from the representatives of the State Division of Forestry, or other fire-control agency involved. In many counties, there are local Range Improvement Committees. These, in coöperation with the Farm Advisor and State Forest Ranger, plan all burns in the area well in advance.

The first step is to apply to the local State Forest Ranger for a permit to burn at a stated time and place.

The second is to cut and clear a firebreak, by removing the brush in a strip around the area to be burned. The ranger must approve this firebreak.

It is customary for the rancher to enlist the help of neighbors, if possible, or to employ other persons, to guard against the spread of flames past the firebreak. There should be plenty of guards at the fire.

Detailed instructions on burning are not included in this circular, as varying conditions must govern the procedure, and directions are set forth by the forest ranger to cover each case.

Usually the local forest ranger, who has had experience in fire fighting, decides when conditions are suitable for burning off the area, and sets the actual date. This does not mean, under the law, that he will assume any responsibility for accidental fire damage to adjacent property. *Responsibility rests with the person to whom the permit is issued.* It is possible to take out insurance at nominal premiums.

A period of high temperature and low humidity is the most favorable for a hot, clean burn, although such weather adds to the chances that the fire may get out of control. With high humidity, on the other hand, the burn may be light, patchy, and unsatisfactory. In dense stands of brush, the understory (ground cover) of grass and weeds is usually either scanty or absent, so that the shrubs themselves must be depended on to carry continuous and killing flames.

Depending upon local conditions, the burning is usually done sometime during the late summer months. In some instances, it has been done after the first fall rains or in the early spring, because the fire is less likely to get out of control. This practice is not always satisfactory. The burn may be incomplete, providing a poor seedbed, and allowing the development of summer weeds which delay the growth of pasturable plants. In contrast, a burn at the time of year when brush is inflammable consumes most of it and leaves a good ash that is an ideal seedbed (see top cover picture and bottom picture on opposite page).

Mechanical Method. Perhaps the outstanding example of the use of mechanical equipment alone to destroy brush is in northeastern California.

NOTE: In some counties, forest fire protection is not under direct jurisdiction of the California Division of Forestry.

1. In the following counties, the California Division of Forestry contracts protection of state responsibility areas to the county: Kern; Los Angeles; Marin; San Mateo; Santa Barbara; Ventura.

2. The California Division of Forestry contracts protection of state responsibility areas to the United States Forest Service in the following counties: Alpine; Inyo; Mono; Plumas; Sierra.

3. The following counties have no state responsibility areas: Imperial; San Francisco; Sutter.

A burn was attempted on this area east of Santa Ana, Orange County, April 3, 1942. Burning brush at the wrong time of year often results in a spotty kill. (Photographed April 16, 1942.)

POOR BURN = SPOTTY KILL

CLEAN BURN = GOOD FORAGE

Grass plots seeded September 27, 1946, in a clean burn near North Fork, Madera County. (Same site as top cover picture.) Sixty acres of recommended mixture were seeded. (Photographed June 6, 1947.)

Near Alturas, Modoc County, a farmer has been very successful over the past 10 years in converting sagebrush land to grassland. He plows a field with a wheatland plow, and seeds cereal rye for a hay crop. When he cuts the rye for hay, any seedlings of sagebrush that have germinated are included in the cut. Then he prepares a firm seedbed, and drills crested wheatgrass and a combination of Ladak alfalfa and yellow sweet clover in alternate rows 1 foot apart. The result is a good dry-land crop of hay and pasture.

Additional thousands of acres of sagebrush in Zone 6 (see p. 19) could be converted to profitable pasture by use of the same methods.

Mechanical Method Followed by Fire. An increasing amount of brush clearing is being done by bulldozer or by a steel rail used to dislodge the standing brush.

The bulldozer is a good tool because it crushes down the brush so that it is compacted and partially dried before being burned. This results in a cleaner burn. The blade of the bulldozer should be held 10 to 12 inches above the ground to prevent disturbance of the soil.

It is necessary to obtain a permit for burning an area cleared in this manner, and to work out details with the forest ranger, just as when fire alone is used. The usual firebreaks also must be provided. A good burn can then be conducted when the fire hazard is not too great.

This dual method has been successfully used in Santa Barbara County. In an area where chamise and other sprouting forms of brush predominated, the brush was removed with a bulldozer and pushed into windrows. After these had been burned, the roots were dug up with a machine developed for the purpose—a ripper which worked like a dump rake. The roots were then pushed into windrows by a bulldozer with heavy teeth, which disturbed the soil very little. When the roots had been burned, the land was ready for plowing. After a year in vetch and oats, or sudangrass, the land was again plowed to destroy brush seedlings, and was then in condition for seeding to a permanent pasture of grasses and legumes. The cost per acre for the entire operation, at wartime prices in 1944, was $25. This comparatively high cost was justified, because the soil is productive.

In Monterey, San Bernardino, and some other counties, another combination of mechanical equipment and fire is used to eliminate crown-sprouting chamise and other brush. Brush on the firebreaks is broken down and burned early in the season, before the standing brush becomes too inflammable. In these counties, bulldozers are used to break the standing brush; after this has been burned, the roots are turned up with a heavy disk plow. A heavy rake, similar to a bull rake, is used to pile the roots together in windrows, where they are burned. The land is then generally seeded to grain. A plowing, after the cereal crop is harvested as grain or hay, serves to kill out brush seedlings. After one or two crops of grain, the land is seeded to pasture. The cost of knocking down the brush for burning will run from $3 to $15 per acre. The total cost of one extensive operation in Monterey County was $15 per acre where the cover was practically all brush. With a cover of 35 per cent oaks, the cost rose to $28.50 per acre.

Similar practices were used on a demonstration area in Nevada County, except that range plants were to be seeded in the ash immediately after burning. Pictures on the opposite page show the mechanical operations. When the brush is knocked down in place, the resulting burn, with even distribution of ash, forms an ideal seedbed.

Before starting on a brush-clearing program involving mechanical equipment, it would be wise to visit ranches where effective equipment and methods have been developed. The Farm Advisor can help through his knowledge of local conditions.

Brush burning trial in Nevada County. General view showing distribution of the brush. (Photographed May 15, 1946.)

Close-up of same field as above, showing brush knocked down and left in place. Result is even distribution of the ash after dried brush is burned.

Equipment used for knocking down brush. Blade of bulldozer has been raised so that it can turn around. Note that soil has not been disturbed. (Photographed May 15, 1946.)

Chemical Treatment. Information on the use of chemicals is rapidly becoming available. Address inquiries to the local Farm Advisor or to the Department of Botany, Davis.

For foliage treatment, the equipment used may be knapsack, ground rig, or aircraft, including fixed-wing planes or helicopters.

For control of chamise, the best results are being obtained by treating the sprouts following the burn. Timing of the treatment is extremely important. After a July burn, chemical treatment should be applied in April of the following year. If the burn takes place in September or later, treatment should be delayed about 18 to 20 months. Material used is a low-volatile ester of 2,4-D or 2,4,5-T, at the rate of 2 pounds in 5 gallons of diesel oil, per acre.

On chamise, the recommended program would be: burn, seed, spray, graze.

The most successful foliage treatment so far has been on coastal sage. Here again, time of application is important. Much experimental work has been carried on by the Farm Advisors in Ventura and Santa Barbara counties. There has been a noticeable increase of native stipa following spraying in Ventura County.

In Santa Barbara County, 115 acres near Los Olivos were sprayed April 12, 1950. The sagebrush was growing rapidly, the new growth being about 3 inches high. A very satisfactory kill was obtained with 2 quarts of 40 per cent alkaline amine salt of 2,4-D in 6 gallons of water, per acre, sprayed by helicopter. The cost was $5 per acre—$2 for material and $3 for the application.

There is no fire hazard when sagebrush killed with 2,4-D is burned late in the season. Coastal sage areas, after burning, will support smilo, veldtgrass, and rose clover particularly well.

Surface treatment can be applied at any time of the year. It appears to be effective on toyon, digger pine, live oak, and scrub oak. One problem that has not yet been solved is that parts of the tree, or of branches, are not always killed.

For surface treatment, shallow cuts 3 to 6 inches apart are made in the bark of stems 2 inches or more in diameter, in a circle around the stem a short distance above ground level. One cubic centimeter of the amine salt of 2,4-D or 2,4,5-T is introduced into each cut by means of a 1-quart pump oil can.

A man can treat up to 8 acres a day by this method. Material costs about $4.50 a gallon. On a 200-acre field in upper Berryessa Valley, Napa County, a total of 25 gallons of 2,4-D amine was used on live oak in 1951.

A basal spray involves spraying the lower bark with a low-volatile ester of 2 per cent 2,4,5-T in diesel oil, and is effective only on stems of small diameter. It is particularly useful in killing scattered small clumps of brush, and in clearing rights of way of utility lines. It has been effective in killing small plants of live oak, poison oak, scotch broom, and most other woody plants.

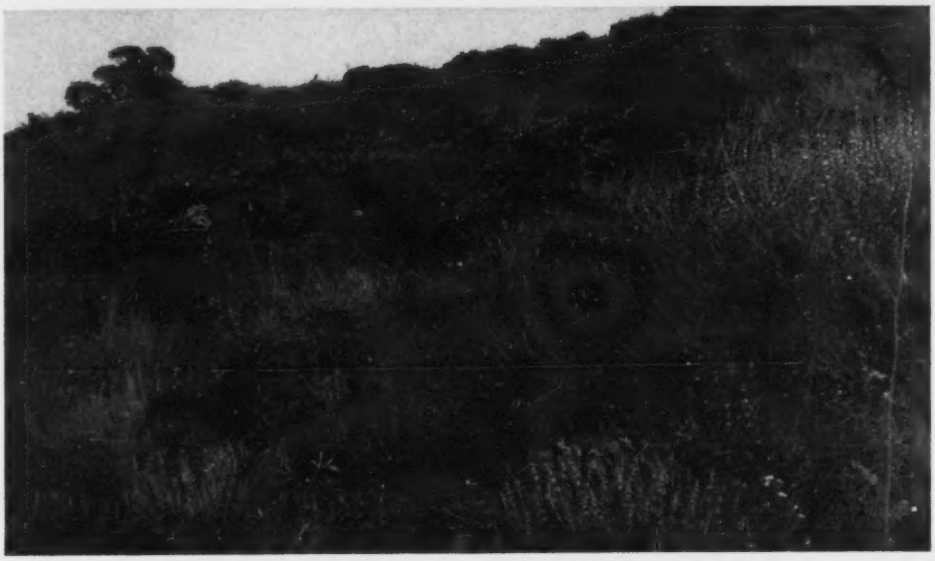
STEP 2: REVEGETATION OF CLEARED AREAS

The second phase of range improvement by brush removal is revegetation. The following considerations largely determine the success of any revegetation plan:

1. Examining the area (before burning) to determine whether artificial seeding will be needed in order to establish a forage crop successfully (table 5, p. 33).

2. Choosing the best methods, time of planting, mixture and amount of seed, if artificial seeding is necessary.

3. Selecting the proper species of forage plants for the zone in which the cleared land is located. (See zone map on p. 19, and table, p. 20.)



Field on El Toro Ranch, Orange County, showing density of brush before burning. Such a stand usually indicates moderately fertile soil which can support a grass cover. The many stipa plants under this brush are not available to livestock. (Photographed April 30, 1943.)

REMOVAL OF THIS BRUSH

GAVE FORAGE A CHANCE

An adjacent portion of the field in upper photo, showing volunteer recovery of foothill stipa after brush burn. (Photographed April 30, 1943.)

Artificial Seeding May Be Necessary

Before an area is burned over, it should be examined carefully to determine whether artificial seeding will be necessary. In many places, seed of forage grasses and legumes must be planted to provide pasturage on the burned-over areas.

As stated earlier, dense stands of tall brush usually indicate a moderately fertile soil which can support a grass cover. Where such stands have been removed, remnants of both annual and perennial grasses and of weedy species are likely to be sparse. During the first year, while seeded plants are establishing themselves in these areas, there is little or no competition from established growth such as that which interferes with seeding on open range (see picture, opposite page).

Artificial seeding in burns is best done on a spot basis, not over the entire area. In open spaces where, before the fire, there was no coverage except grass or sparse brush, seeding is not only unnecessary, but also likely to be unsuccessful.

In any operation that is not to be continuous over the whole area, best results will come from seeding on the less exposed slopes and the deeper soils.

Natural Seeding. It may well be that sufficient seed of perennials and annuals is present in the brush to make artificial seeding unnecessary.

An example of this condition was observed on a range in Orange County. On this range of 1,000 acres, no pasturage was available for cattle because they would not go through dense brush (see top photo, page 11) either to harvest scant feed growing there or even to reach the more liberal feed growing in open spaces. After the brush was burned, in the fall of 1942, recovery of foothill stipa bunchgrass was almost immediate. In many places, including hillsides as well as swales, the grass reached a height of 3 feet (see bottom photo, page 11). There was no evidence of soil erosion, and the 1,000 acres now carry 300 cattle for seven months of the year.

Low-growing shrubs, such as wild buckwheat, occasionally have a good understory of grasses and herbs, so that areas where such growth is present may be expected to bear a good natural cover the first year after burning.

An accidental burn of this type of brush near Temecula in Riverside County was observed in 1941, the year after burning, and in subsequent years. An excellent stand of forage came up after the first fall rains. According to conservative estimates, the burned area produced more than twice as much feed as did the unburned portions of the range. This grass defended the slopes perfectly against erosion, although the soil in that area is highly erosible, and the first winter after the fire was one of unusually heavy and severe rainfall. The essential point is that in this stand of low shrubs there were ample remnants of annual and perennial forage plants to revegetate the entire area naturally.

Artificial Seeding. Thousands of test plots have been seeded, from 1937 to 1951, in 51 California counties, by the Agricultural Extension Service and the Division of Agronomy. The University of California School of Forestry and other state and federal agencies have carried on extensive programs in recent years. A number of these were seeded in the ash of brush burns. In addition to the test plots, a considerable number of acreage seedings in brush burns were observed. More recently, extensive investigations have been conducted by the Experiment Station in coöperation with Farm Advisors and ranchers.

Judging from the tests and observations in burned areas, the ash of a heavy brush burn is an ideal medium in which to plant seed. Where the annual rainfall is such that the sown plants can survive dry summers, such seeding is successful. The ash of *grass* burns is *useless* as a seed-

Grass plots seeded December, 1944, immediately after a burn near Kelsey, El Dorado County. This hillside was covered with manzanita and poison oak. Plot at left is domestic ryegrass; at right, tall oatgrass. Note absence of volunteer plants in strip between plots. (Photographed July 10, 1945.)

bed for most seeded species because a grass fire does not kill all the seeds of resident annuals, which start vigorously in the fall and crowd out the seeded species. Center photo on cover shows growth of harding the first June after seeding, near Bridgeville, Humboldt County.

Some trial plots have been subjected to a series of detailed observations for a period of eight or nine years. In Mendocino County near Yorkville, a landowner had been seeding a mixture of ryegrass, hardinggrass, and orchardgrass in brush and slashed timber ash. On October 18, 1943, the writers seeded a test plot of grasses and legumes on the ash on a southerly exposure. The plots were not fenced, and received the same grazing treatment as the remainder of the range. Table 1 gives details of the recorded data. Notes were taken the first year after seeding, in February, April, and July of 1944; in June of the second and third years; in May of the fourth year, and in July of the seventh year. The first-year results obtained here, as elsewhere, demonstrate the slow initial development of the seeded perennial grasses and legumes. In some plots there was a grass burn rather than a brush burn, and significantly on such sites the stand of seeded species was much poorer than on the brush ash. The plants were not strong and sturdy. This statement applies particularly to smilo, harding, and the stipas. The plots were seven years old at the last reading, and, as will be seen from the last column of Table 1, a good mixture of grasses and legumes can be made up of the plants that succeeded. Subterranean clover was the outstanding legume.

On a more favorable site near Comptche in Mendocino County, a series of similar plots was seeded by broadcasting in the fresh ash of a brush burn in the fall of 1944, and still another series in the fall of 1945. Notes have been taken each year in June. No field was grazed until the July after seeding.

TABLE 1—Example of Notes Taken on Trial Plots near

Species and key numbers	February 25, 1944		April 12, 1944		July 17, 1944	
	Stand*	Height	Stand*	Height	Height	Development†
		inches		inches	inches	
Tall oatgrass, 6	FG	1–3	FG	3–7	36	R, Gn
Tall fescue, 8	FG	1–3	FG	3–6	24	R, Gb
Annual ryegrass, 13	G	2–6	VG	6	24	R
Perennial ryegrass, 14	G	2–6	VG	6	28	R, Gb
Birdsfoot trefoil, 16	G	½–3	G	2–4	6–20	Fl
Alfalfa, 17	G	1	G	2–3	3–12	Gn
Bur clover, 20	F	1–2	F	2	6	R, D
Smilo, 26	F	1	F	2–4	24	Fl
Hardinggrass, 28	G	1–3	G	2–6	30	R, Gb
Burnet, 30	F	1–3	F	3–5	6–20	R, Gb
Nodding stipa, 34	F	1–2	F	6	24	R, Gb
Purple stipa, 35	F	1–2	F	6	24	R
Subclover, 56	G	1–2	G	6	12	R,
Sweetclover, 61	G	1–2	G	3	6	Gn
Orchardgrass, 63	G	2–5	G	6	30	R, Gb

* Stand: VG = very good; G = good; FG = fairly good; F = fair; P = poor; 0 = no plants found.
† Development: R = ripe; Fl = flowering; H = heading; Gn = green; Gb = green at the base; D = dead or dry.
‡ Grazed closely by rabbits.
§ Spreading.

Test plots seeded in December, 1944, on a burn near Kelsey in El Dorado County, have been observed for six years. This site has an elevation of about 2,300 feet, and an average annual rainfall of 40 inches. At the last observation, in May, 1950, the results indicated that tall oatgrass, smilo, California oatgrass, the ryegrasses, hardinggrass, burnet, the stipas, and orchardgrass are well adapted to that area. Stands of alfalfa and subterranean clover (now called "subclover" in the seed trade) were improving (see photo, p. 13).

Chamise is generally considered to occur only on the poorest soils, but there are so many thousands of acres covered with this worthless brush that seeding experiments have been conducted on it.

Test plots were seeded in November, 1946, on a burn south of State Highway 20, in Colusa County, just east of the Lake County line. Twenty-nine varieties of grasses and legumes were seeded in long, narrow plots on a severe south slope. A drift fence prevented grazing except by the deer. The species included: two varieties of tall oatgrass (6, 6A); California bromegrass (7); tall fescues (8, 8A); ryegrasses (13, 14); birdsfoot trefoils (15, 16); alfalfas (17, 18); prairie brome (25); smilo (26); hardinggrasses (28, 28A); burnets (30, 30A); stipas (34, 35); subclovers (56, 98); yellow sweetclovers (61, 61A); orchardgrass (63); veldtgrass (91); harlan brome (100); crimson clover (101); and rose clover (102). (Figures in parentheses are key numbers. For an explanation of the key, see p. 22.)

As expected, the short-lived plants looked better the first year, but beginning with 1948 and continuing since then, the performance of smilo, harding, and the stipas has been outstanding. Alfalfa, burnet, tall fescue, and orchardgrass can still be found.

In 1949, 300 acres of a burn on the same ranch were seeded to smilo and harding. Large plots of several grasses

Yorkville, Mendocino County, Seeded October 18, 1943

June 10, 1945			June 10, 1946			May 16, 1947			April 27, 1951		
Stand*	Height	Development†	Stand*	Height	Development†	Stand*	Height	Development†	Stand*	Height	Development†
	inches			inches			inches			inches	
VG	48	Fl	VG	48	Fl	VG‡	36	Fl	F	12	H
G	36	Fl	G	24	Fl	G	24	H	F	12	Gn
G	20	Fl	G	24	H	G	20	H	P	6	H
G	24	Fl	G	18	H	G	18	J	P	6	Gn
G	8	Gn	P	8	Fl	FG‡	16	Gn	0	..	..
F	4	Gn	P	6	Gn	FG	10	Gn	0	..	..
P	6	R, D	P	6	R	P	6	Fl	F	6	R
FG	30	Gn	G	30	Fl	FG	10	Gn	FG	10	Gn
FG	24	Fl	FG	24	Fl	FG	8	Gn	G	10	Gn
G	3§	Gn	FG	12	Fl	F	6	Fl	F	3	Gn
G	30	R, Gb	G	30	Fl	G‡	24	Fl	G	18	H
[illegible]	24	R, Gb	FG	30	Fl	FG	24	H	FG	6	Gn
[illegible]	12	R	G	12	R	VG‡	15	R, Gb	VG	15	Fl
0	..	..	0	..	..	0	..	..	0	..	..
G	10	Fl	G	10	Fl	G	12	Fl	G	12	Fl

and legumes were seeded by the Farm Advisor. Satisfactory stands of the two grasses were obtained in spite of the severe winter, and the rose clover in the plots has increased each year.

Methods Used in Artificial Seeding

Planting the Seed. Seed can be broadcast by hand, by the use of a breast seeder, by an endgate seeder (if the topography and brush stumps will permit its use), by drill, by plane, or by helicopter. The method chosen will depend on the type of area involved and the complexity of the seed mixture to be planted.

Where mechanical equipment alone is used to clear the land of brush, best results will come from preparing an alfalfa-type seedbed. The seedbed must be firm. After brush has been removed from the land, and it has been disked, it should be rolled with a cultipacker or ringroller. The seed should be drilled, if possible.

Even where airplane seedings are made on the ash, it should be emphasized that the better seedbeds insure the better stands. Where the rainfall pattern is unfavorable, the seed should be covered after planting and the seedbed firmed so that moisture will be maintained at the seed level. Recent tests in San Diego County have shown that the extra treatment made all the difference between success and failure (see photo, p. 16).

For any method chosen, preliminary tests should be made, using a given amount of seed over a measured area, to determine the proper distribution of the seed. Seeding can then be adjusted to approximately the desired rate.

Time of Planting. The seed should be sown in the ash before the fall rains.

Seasonal variations in precipitation and temperature make it very difficult to determine accurately the exact reasons for success or failure of plantings. However, successful seedings have been made as long as 14 months and even three years after the fire. Lack of invasion by resident

annuals, resulting in lack of competition for seeded species, seems to be an important factor in these instances.

Seed Mixtures. Annuals grow and mature on winter moisture at shallow depths. The roots of perennial grasses and legumes, however, extend more widely and deeply, so that most range areas will support, permanently, fewer individual plants per unit area. The problem is one of moisture and fertility limitation. Probably an ideal average composition of range forage would include perennials and desirable annuals—40 per cent legumes, 60 per cent grasses.

It is not wise to limit the opportunity of establishing long-lived perennials by mixing the seeds of perennials with heavy seedings of fast-growing annuals, such as ryegrasses or cereal rye, which start early and grow as rapidly as the resident annuals. Avoid seeding these annuals heavily in a mixture with slow-starting perennials because they will compete with the perennials for moisture and sunlight, as do the resident species on open range. Although cereal rye develops rapidly, it is an annual and does not readily volunteer. When this species disappears, annual grasses and weeds will take over, and the chance to establish perennials will be gone (see photo, opposite page).

The aim should be to have enough seed of rapidly growing species in the mixture to insure 25 per cent to 50 per cent ground cover, and yet not enough to crowd out the perennial plants in the mixture. This can usually be achieved by adding ½ pound of ryegrass or 2 pounds of one of the bromegrasses to the mixture.

What constitutes a good stand of annuals would be entirely too thick for perennials.

Mixing the Seed. It is recommended that seeding in burns with a small percentage of ash areas be done on a spot basis rather than over the entire area. This prevents waste of much high-priced

Rancho Samatoguma near Guatay, San Diego County, shows desirability of some seedbed treatment after seeding on ash. Area burned August 18, 1950; seeded with a mixture of annual ryegrass, soft chess, cucamonga brome, bur clover, and rose clover, September 27, 1950. Area at left disked after seeding; center, no treatment after seeding; right, rolled with sheepfoot cultivator after seeding. (Photographed June 15, 1951.)

Cereal rye seeded in a burn in Nevada County. This dense stand will soon disappear because rye does not volunteer well. In this area, the opportunity of establishing perennials was thus lost. Compare with photo on opposite page. (Photographed May 15, 1946.)

seed. The best plan is to buy seed unmixed and prepare the desired mixture.

A "spot" or "ash mix" is broadcast only where there is a good, white, brush ash. This mixture should contain perennials chiefly. This will establish colonies of, for example, hardinggrass and rose clover on the ranch. Proper seasonal use will insure their spread. If the total area is to be seeded by plane, a "general mix" is best.

Examples of these seed mixtures are given in Table 2.

Rate of Seeding. Until recently, one handicap in the seeding program has been the scarcity of seed of the more promising species, resulting in high cost of seed per pound. Now, however, there are ample supplies of smilo, harding, tall fescue, orchardgrass, and rose clover at fairly reasonable prices. The expense is further reduced because there are many thousands of grass and legume seeds per pound (Appendix, p. 36), so that an apparently low seeding rate is really adequate, especially where there is a good brush burn. The photo on page 25 shows a crop that was seeded at the rate of 4 pounds per acre, near Rescue, El Dorado County.

In the last few years, experience has shown that where conditions are favorable, a seeding rate of from 4 to 8 pounds per acre gives a satisfactory ground cover and provides severe competition for the brush seedlings if the land is not grazed the first spring after seeding.

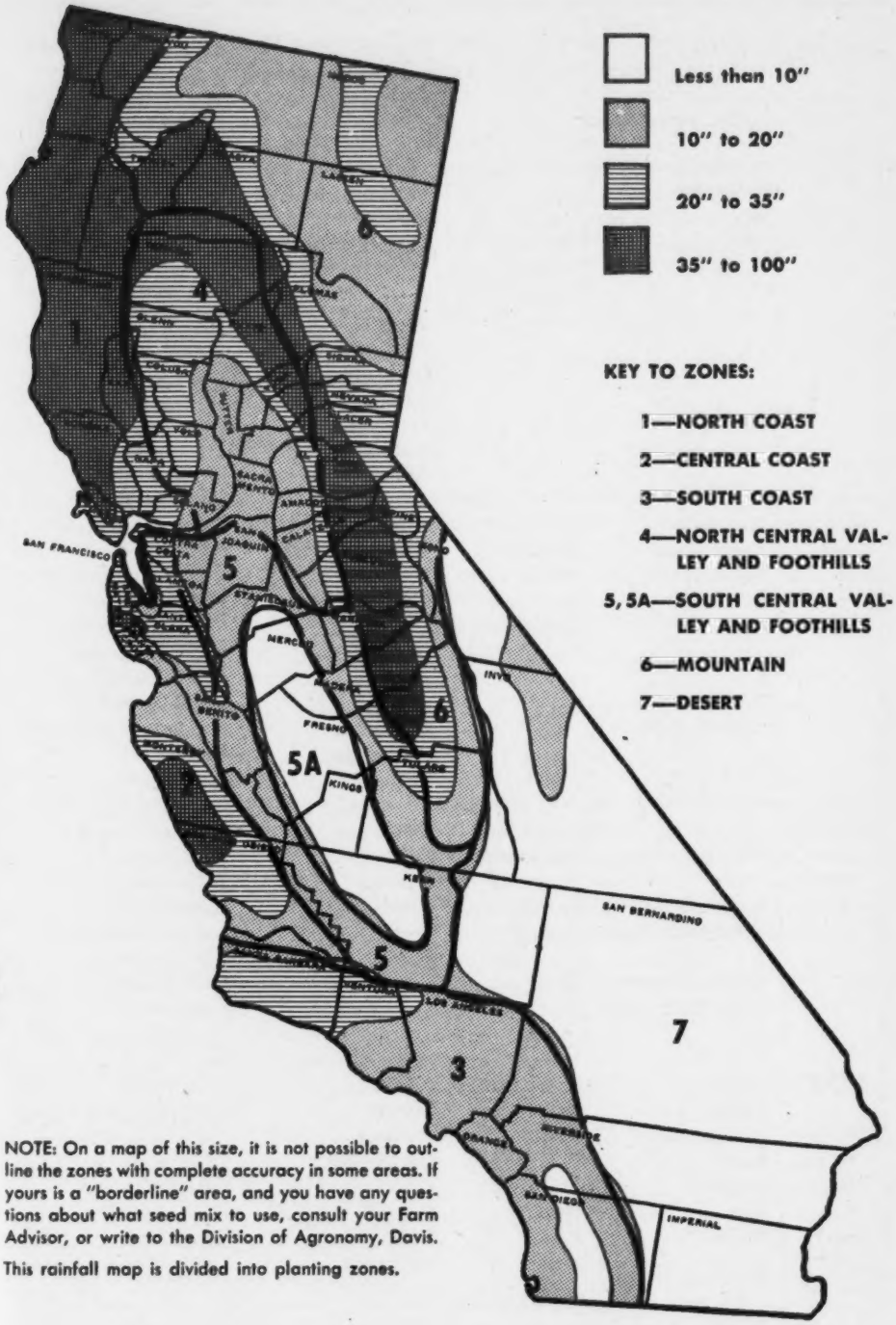
A general mix of 5 pounds of seed per acre (1 pound each of hardinggrass, smilo, alfalfa, annual ryegrass, and rose clover) will result in the distribution of about 45 seeds per square foot (see Appendix, p. 36). This is adequate where there is good ash, and a heavier rate provides no guarantee of a stand on the grass-burn areas.

Brush ash (see top cover picture) forms an ideal seedbed for such hardy perennials as harding, smilo, tall fescue, stipas, alfalfa, and birdsfoot trefoil.

TABLE 2—General Mix Suggestions for Average Sites in the Various Zones, with Locations of Actual Plantings*

Zone	Location	Species	Proportions
1	Near Bridgeville, Humboldt County	Harding	1 : 5
		Orchardgrass	1 : 5
		Smilo	1 : 5
		Burnet	1 : 5
		Subclover	1 : 5
2	Near Pozo, San Luis Obispo County	Harding	1 : 5
		Tall fescue	1 : 5
		Orchardgrass	1 : 10
		Smilo	1 : 10
		Alfalfa	1 : 5
		Rose clover	1 : 5
3	Near Alpine, San Diego County	Veldtgrass	1 : 4
		Smilo	1 : 4
		Harding	1 : 4
		Rose clover	1 : 4
4	Near Rescue, El Dorado County	Harding	1 : 6
		Tall fescue	1 : 6
		Smilo	1 : 6
		Burnet	1 : 6
		Alfalfa	1 : 6
		Rose clover	1 : 6
5	Near Oneals, Madera County	Harding	1 : 4
		Tall fescue	1 : 4
		Smilo	1 : 4
		Rose clover	1 : 4
	Near Badger, Tulare County	Harding	1 : 6
		Tall fescue	1 : 6
		Orchardgrass	1 : 12
		Smilo	1 : 12
		Prairie brome	1 : 6
		Alfalfa	1 : 6
		Rose clover	1 : 6
6	Near Alturas, Modoc County	Crested wheatgrass	2 : 5
		Ladak alfalfa	2 : 5
		Yellow sweetclover	1 : 5

* Ryegrasses do well in most burns, but should be used with discretion (see text, pp. 16, 27). The rate of seeding (see text) will vary from 4 to 8 pounds of the mixture per acre.



NOTE: On a map of this size, it is not possible to outline the zones with complete accuracy in some areas. If yours is a "borderline" area, and you have any questions about what seed mix to use, consult your Farm Advisor, or write to the Division of Agronomy, Davis.

This rainfall map is divided into planting zones.

See Table 3, next page

TABLE 3—Zones for Planting in California Counties, and Recommended Species of Long- and Short-lived Grasses and Legumes

Zones	Counties included in zone*	Long-lived species	Short-lived species
ZONE 1 (North coast)	Del Norte Humboldt Marin Mendocino Sonoma Western part of: Lake Napa Siskiyou Solano Trinity	Alfalfa Birdsfoot trefoil Burnet California oatgrass† Chewings fescue Creeping red fescue Harding Highland bentgrass Orchardgrass Purple stipa† Smilo Tall fescue Tall oatgrass	Bur clover Crimson clover Harlan brome Prairie brome Mountain brome Ryegrasses Rose clover Subclover
ZONE 2 (Central coast)	San Mateo Santa Clara Santa Cruz Western part of: Alameda Contra Costa Monterey San Benito San Luis Obispo Northern part of: Santa Barbara	Alfalfa Birdsfoot trefoil Burnet California oatgrass† Harding Orchardgrass Smilo Stipas† Tall fescue Tall oatgrass Veldtgrass	Annual ryegrass Bur clover Crimson clover Harlan brome Mountain brome Prairie brome Rose clover Subclover Yellow sweetclover
ZONE 3 (South coast)	Orange Ventura Western part of: Los Angeles Riverside San Diego Southern part of: Santa Barbara Southwest part of: San Bernardino	Alfalfa Burnet Harding Rhodesgrass Smilo Stipas† Veldtgrass	Annual ryegrass Bur clover Crimson clover Harlan brome Mountain brome Prairie brome Rose clover Subclover Yellow sweetclover
ZONE 4 (North Central Valley) (less than 35" rainfall)	Colusa Glenn Sacramento Sutter Tehama Yolo Yuba Western part of: Amador Butte Calaveras El Dorado Nevada Placer Tuolumne Southern part of: Shasta Eastern part of: Lake Northern part of: Solano	Alfalfa Burnet Harding Orchardgrass Smilo Stipas† Tall fescue Veldtgrass	Bur clover Crimson clover Harlan brome Mountain brome Prairie brome Rose clover Subclover Yellow sweetclover

TABLE 3 (Continued)—Zones for Planting in California Counties, and Recommended Species of Long- and Short-lived Grasses and Legumes

Zones	Counties included in zone*	Long-lived species	Short-lived species
ZONE 5 (South Central Valley) (less than 20" rainfall)	Kings Merced San Joaquin Stanislaus Eastern part of: Alameda Contra Costa Monterey San Benito San Luis Obispo Western part of: Fresno Kern Madera Mariposa Tulare	Alfalfa Burnet Goar tall fescue Harding Smilo Stipas† Veldtgrass	Annual ryegrass Bur clover Rose clover Subclover
		Up to 3,000 feet elevation OR 35" or more rainfall	
ZONE 6 (Mountain)	Alpine Lassen Modoc Plumas Sierra Northern part of: Shasta Western part of: Mono Eastern part of: Amador Calaveras El Dorado Fresno Madera Mariposa Nevada Placer Siskiyou Trinity Tulare Tuolumne	Alfalfa Birdsfoot trefoil Burnet Harding Orchardgrass Smilo Tall fescue Tall oatgrass Timothy	Bur clover Crimson clover Harlan brome Mountain brome Prairie brome Ryegrasses Rose clover Subclover Yellow sweetclover
		Over 3,000 feet elevation AND less than 20" rainfall	
		Crested wheatgrass Intermediate wheatgrass Ladak alfalfa Orchardgrass Smooth brome Tall fescue	Mountain brome Yellow sweetclover
ZONE 7‡ (Desert)	Imperial Eastern part of: Inyo Kern Los Angeles Mono Riverside San Bernardino San Diego		

* Counties listed alphabetically for convenience. Consult your local Farm Advisor for mixture to be used.
† Indicates species not yet available commercially but which are included since they will be on the market shortly.
‡ There is no discussion of brush removal for Zones 7 and 5A.

Choosing the Right Forage Plants

Since 1937, more than 200 species of forage plants have been tested in trial plots in 51 counties. Each of the species has been assigned a permanent key number, as shown in the Appendix, page 36.

These key numbers are the same as those listed in Extension Circular 129, "Improving California Ranges" (1943), but species and varieties that have been added since 1943 have been given new key numbers. Those listed in the Appendix, with their key numbers, are given in the recommendations in Table 3, page 20. The importance of the key numbers is illustrated by reference to No. 25. The scientific name of this grass is *Bromus catharticus* Vahl. (*Bromus unioloides* Kunth). This scientific name also applies to the rescuegrasses of the southwestern United States, many of which are annuals. No. 25, however, is a perennial strain of *B. catharticus* that was introduced from New Zealand to California. It is much better adapted to California conditions than are many of the "rescuegrasses" that are on the market. The seed was collected by Wayne H. Fisher on a trip to New Zealand, and he gave it to L. G. Goar of the Division of Agronomy, as part of a large collection of grasses and legumes. In New Zealand it is commonly called prairiegrass. The writers suggest the common name prairie brome (or brome 25) for this certified strain, to avoid confusion with the rescuegrasses.

Species Recommended for Certain Zones. Many of the plants are limited in their distribution, others are widely adaptable. Zones have been set up in the state, as a result of the test plots and acreage seedings observed. A map outlining the seven zones into which the state has been divided is shown on page 19. Table 3 (p. 20) lists short- and long-lived species adapted to each zone.

The recommended species described below are listed alphabetically by their common names. When a species has a key number, it is given in parentheses following the name. Scientific names of the various species are listed in an Appendix beginning on page 36. Table 4, page 31, gives growth habits and grazing use of the main types of range forage plants.

Long-lived Perennials

GRASSES

California Oatgrass (9)—This native perennial bunchgrass forms a rather low-growing tuft of basal leafage. The stems usually break at the crown when mature. It is palatable and nutritious. Its natural distribution extends from Monterey County north in the coast ranges, and along the Sierran foothills above 2,000 feet. Seedling development is extremely slow, and germination is usually low. A strain with a higher percentage of germination has recently been selected. Seed may be available within the next few years.

Chewings Fescue (11B)—This bunchgrass has fine, basal leafiness. In Zone 1, where it is adapted, it does well under moist or dry conditions. Main growth occurs in spring and early summer. Chewings fescue is high in palatability, and makes a good combination with highland bentgrass as a competitor for Klamath weed. Seed is available.

Crested Wheatgrass (1)—This is a hardy, drought-resistant, perennial bunchgrass, native to the cold, dry plains of Russia and Siberia. It is known in the seed trade as Standard crested wheatgrass.

Standard crested wheatgrass can grow at low temperatures, and makes early, rapid spring growth. During hot weather it becomes dormant, thus protecting itself against drought. It does well in its zone of adaptation on almost any soil ranging from light sandy loam to heavy clay.

In California it has done well only in Zone 6 (elevations above 3,000 feet). In Modoc and Siskiyou counties it is being

used in combination with Ladak alfalfa and yellow blossom sweetclover to seed reclaimed sagebrush land. Seed is commercially available.

Hardinggrass (28)—This perennial grows in large, dense, leafy tufts. Once established, it is very persistent although it is a poor competitor during the seedling stages. It is one of the few perennials to make good growth in winter when most other plants are dormant, but it will not survive the cold winters of northeastern California. It grows best on heavy, black soils and deep volcanic loams, but will produce well on lighter soils underlain by heavier strata. Though tall and rather coarse, its abundant leaves are relished by all classes of livestock.

It is one of the best and most durable dry-land grasses. It is especially useful for seeding in the ash of brush burns.

Grown in combination with dry-land alfalfa, it has done exceptionally well in the coastal areas from Monterey to Del Norte County, and in the Sierra foothill ranges above the 15-inch rainfall belt.

Highland Bentgrass (112)—This is another perennial adapted chiefly to the north coast area (zone 1) of California. It has fine, basal leafiness that is fairly palatable. It provides good spring and early summer forage under moist to dry conditions, and is a good competitor for Klamath weed. Seed is available.

Intermediate Wheatgrass (109)—This perennial spreads by means of underground stems and produces an open sod. Although adapted to about the same climatic conditions as crested wheatgrass (zone 6), it is not so drought-tolerant as the latter. It requires 15 inches or more annual rainfall. It has strong seedling vigor, and is thus better able to compete with resident weeds than are most perennials. It has done well in trials in Lassen County. Seed of this species is still difficult to obtain.

Lomasgrass (113)—A variety of blue wildrye, this is a long-lived, early maturing bunchgrass, native to California. Native plants are somewhat sparse-leaved. Domesticated strains are somewhat better in this respect. Soil Conservation Service tests indicate it can be established on prepared sites, but little information is available with regard to seeding it in the ash of burns. Although the species appears to have some promise, the Agronomy Division is not recommending its use pending results of further field tests.

Orchardgrass (63)—This perennial is readily distinguished by its large, circular bunches, folded leaf blades, and flattened sheaths (especially at the base of the stems). The shape of the flower head has suggested the English name of "cocksfoot." It has remained popular in pasture mixtures here because it is hardy, persistent, aggressive, and, in the earlier stages, is relished by all classes of livestock including sheep.

Orchardgrass has proved widely adaptable for range use. It is not quite so drought-tolerant as tall fescue, but will tolerate more shade. Akaroa (63A), a new strain, appears to be slightly more productive than common orchardgrass, but may not be so drought-tolerant. It is more subject to winter heaving than is common. Seed is commercially available.

Redtop (105)—A hardy perennial, it has a creeping habit of growth which makes a coarse, loose tuft. It is a wet-land type of grass, but will withstand considerable drought. Although primarily adapted to mountain meadows and pastures, it may have a place as a sod-former in seepage areas where it will furnish late feed. Its normal maturity dates are similar to those of timothy. It is not adapted for general use on dry-range seedings. Seed is available.

Rhodesgrass (67)—This perennial, fine-stemmed, leafy grass grows to an average height of nearly 3 feet under favorable conditions. It spreads by running branches which root and produce tufts at the joints. It will not withstand winter temperatures below 18° F. It is especially suited for use on sandy sites south of the

Tehachapi although it survives in warm sites, at elevations below 1,500 feet, as far north as Modesto.

Sherman Big Bluegrass (103)—A variety of big bluegrass native to the Palouse prairie, this is a robust, perennial bunchgrass adapted for use in California at elevations above 1,500 feet. The plants are tufted, vigorous, about 2 to 4 feet tall, and have numerous basal leaves. The fibrous roots penetrate deeply. It starts growth in early spring and continues into the fall. It seems particularly adapted for use on adverse soil and climatic sites. Although trials in the central foothills of the Sierra indicate this as a promising species for seeding brush burns, recent tests in Arizona showed that it is the least palatable of the grasses tested. Seed is commercially available.

Smilo (26)—Because it has been difficult to obtain stands of smilo on prepared sites, use of this valuable grass has been extremely limited. Following numerous trials in the ash of burned brush, however, the certified strain can now be recommended, especially on chamise burns, since successful stands are almost invariably obtained under such conditions. Smilo has about the same climatic tolerance as hardinggrass, but should be used on lighter soils. It will not survive severe winters. It is palatable, drought-resistant, and long-lived, and, given a chance, it volunteers well. It is a tall, leafy bunchgrass with an extensive root system.

Treatment of the seed in pure Clorox for one hour materially improves germination. Treatment is not recommended for general range use, however, because in most winters it is better to have seeds germinating over a long period to avoid loss of the crop through unfavorable climatic conditions following germination.

Smilo has been grown successfully from San Diego to Humboldt County on the coast ranges, and from Kern to Shasta at intermediate elevations in the Sierra ranges. Seed is now commercially available.

Smooth Brome—A perennial, tall-growing, leafy grass that spreads by underground, creeping rootstocks. These tend to become sod-bound in a few years so that renovation is necessary for best results. Although popular as a hay and pasture plant in northeastern California, it has never found a place in any part of the state where winters are mild and summer temperatures high. General use, therefore, is not recommended. In the northeastern counties it frequently is grown to advantage dry-land in association with Ladak alfalfa. The Lincoln strain (64) has looked particularly promising in Zone 6. Seed is available.

Stipas—Nodding stipa (34) and purple stipa (35) are among the hardiest of the native California bunchgrasses. They have a wide adaptation, in the coast ranges from San Diego to Del Norte counties, and similarly in the Sierra Nevada foothill area from south to north. Nodding stipa, the hardier and more drought-resistant grass, extends beyond the tree line of the woodland-grass association.

Each species has been subjected to selection at Davis, and the foundation seed for each is a blend of 12 superior strains. This blend assures wide adaptation. It is recommended that some of each species be sown in a mixture since the species hybridize, developing a moderate stand of field hybrids of strong vigor and late summer green growth. The technique of seed production is nearing solution. Commercial quantities of seed are now beginning to appear.

Tall Fescue—This selection is out of meadow fescue, but more drought-tolerant, thriftier, and taller in growth than the parent, with more basal leaves. Selections of tall fescue have now replaced meadow fescue for dry ranges in California. A long season of growth and high production of forage have resulted in its extensive use and wide popularity. It has proved useful on the range in areas of 20 inches of rainfall or more. It will reseed itself.

Alta fescue (8) is an Oregon certified strain. Kentucky 31 (8A) is a strain certified by the Kentucky Crop Improvement Association. Goar strain (8B) was developed in California. For California range use, these are all superior to meadow fescue. Goar tall fescue has very strong seedling vigor, and may be more alkali- and heat-tolerant than the others.

Tall fescue strains are late winter, spring, and summer growers. The plant goes into dormancy late, after the soil moisture has been exhausted. Seed of all three strains is commercially available.

Tall Oatgrass (6)—This is a fairly hardy, upright, perennial bunchgrass, growing 30 to 60 inches tall, and producing many leaves. It has an open head, or panicle, resembling that of cultivated oats, although the seed is smaller and much more chaffy. It prefers well-drained soil and seems to do well on light sandy or gravelly land. It does not like the shade. It starts growth early in the fall and is considered a winter grower. Tall oatgrass has done well in dry-land tests in coastal areas of California and at higher elevations in the Sierra. For best results, the species should be used under a rotational or controlled grazing program. The Tualatin strain (6A) is an improved, comparatively nonshattering strain developed in Oregon. It has done well in California tests. The species has been observed to reseed in coastal, central, and northern California. Seed is commercially available.

Tall Wheatgrass—Notable among the newer grasses being tried in the mountain zone is this tall, vigorous bunchgrass. Although it is very alkali-tolerant, its palatability is low if it is grown under extremely alkaline conditions. On fairly neutral soils it appears to have the same

This area near Rescue, El Dorado County, was seeded at the rate of 4 pounds per acre, by the State Division of Forestry. The mix used was the same as the one shown in Table 2 (p. 18) for Zone 4. Brush was burned standing, and bulldozed to knock down burnt stems. Area was seeded by plane. (Photographed July 9, 1951.)

degree of palatability as other wheatgrasses. Very little seed is available commercially.

Timothy (106)—This is a perennial and, like redtop, a northern species. It is frequently used as a hay and pasture plant in high areas of cold winter and moderate summer temperatures, but has never been durable when used in a mixed pasture in the lower elevations of the state. Seed is available commercially.

Veldtgrass (91)—Native to South Africa, this grass has done particularly well in sandy soils in the south and central coastal areas.

A two-acre planting seeded in 1942 near Corona del Mar, Orange County, has now spread over two more acres. Other successful acreage seedings have been observed in San Diego, Ventura, and Santa Barbara counties. Recent tests indicate its range of usefulness extends as far north as Humboldt County, on light soils.

Perennial veldt is very palatable and drought-resistant, but it is not so long-lived as the stipas or smilo. Because the seeds on the panicles (heads) ripen over a very long period, it is difficult to obtain large seed yields. Thus seed is likely to be high-priced, but the fact that it volunteers readily will help compensate for the initial high cost.

Veldtgrass seed can be obtained occasionally from Australia. One imported strain is known as "Unarlee" (91A). Limited supplies of the California strain (91) are now available.

Wheatgrasses—In addition to the wheatgrasses described above, a number of other species are coming into prominence for pasture use in cold regions. Most of these, such as pubescent wheatgrass and slender wheatgrass, are now being tested thoroughly in Zones 1 and 6. Consult your Farm Advisor for current results and recommendations.

LEGUMES

Alfalfa—California Common (17) is proving a valuable perennial legume for use on better dry-range sites. If the plants are to persist on such sites, however, rodents must be controlled. Also, alfalfa should be used on soil at least 3 feet deep, and in areas having an annual rainfall of 15 inches or more. At higher elevations in northern counties, either a local strain of California Common or Ladak (18) should be used to obtain the necessary cold resistance or hardiness.

Broadleaf or Erect Birdsfoot Trefoil (15)—The species is extremely variable but, in general, shows a more erect type of growth than does the narrowleaf. As indicated by the common name, broadleaf trefoil has wider leaflets that tend to be shorter than those of narrowleaf trefoil. Flowers of the broadleaf type may also be somewhat larger. In regions of cold winters, broadleaf trefoil may survive where the narrowleaf type is severely damaged or entirely killed.

Narrowleaf or Prostrate Birdsfoot Trefoil (16)—It is a perennial legume which, in some respects, resembles a fine-stemmed, fine-leaved alfalfa. Stems vary in habit of growth but usually are creeping or spreading, seldom erect. New shoots develop from a crown similar to alfalfa, but they are much more branching. Leaves are arranged in groups of five leaflets, three at the end of a short branch, or petiole, and two on opposite sides at the base of the petiole or at the point of attachment with the main stem.

Until more is known regarding the comparative adaptation of these species, only general recommendations can be made. It appears that the narrowleaf type should be used under very alkaline conditions; the adaptation of broadleaf trefoil to alkali is unknown. At higher elevations, in the absence of alkali, the broadleaf type may be used. Under all other situations requiring trefoil, a mixture of the two types may be advisable.

In the Blocksburg area of Humboldt County, the narrowleaf strain has persisted under heavy use, whereas the broadleaf has disappeared.

Neither species of trefoil is as drought-tolerant as alfalfa under range conditions.

OTHER SPECIES

Burnet (30)—Burnet is a perennial herb and member of the rose family. It is as palatable and nutritious as filaree, and stays green all summer if moisture is available. It volunteers well and has strong seedling vigor. A tap-rooted perennial, it tends to rosette near the ground. This crowding habit allows it to withstand heavy grazing and makes it a strong competitor against weedy annuals. In Humboldt County it has been used as a good competitor for Klamath weed. It can be expected to yield well on good soils. Burnet begins to grow with the first winter rains, and continues to do so until about midsummer when it goes into dormancy. Because of its taproot, it is very susceptible to rodent damage. Wherever the soil is deep, other deep-rooted species, such as alfalfa, have been more productive. In difficult sites, burnet may find wider usage. Seed is available.

Short-lived Perennials and Desirable Annuals

GRASSES

Annual Ryegrass (13)—Practically all the cultivated ryegrasses originate in two species: *Lolium multiflorum*, most commonly called "Italian ryegrass" or "annual ryegrass," and *L. perenne*, generally called "perennial ryegrass," or "English ryegrass." Both are short-lived grasses. Commercial seed now marketed here is most commonly known as either Western-grown or domestic ryegrass, and it is fairly certain that this contains a considerable percentage of hybrids with perennial ryegrass. In any event, parent plants have been known to survive in California for three or four years.

All strains of annual ryegrass can be distinguished from perennial ryegrass by the emerging leaves which, in the annual, are rolled, and in the perennial, folded. Generally, there are short awns on annual ryegrass seeds and not on perennial.

Annual ryegrass is more stemmy and less leafy than perennial. It is popular as a range plant in California because it is palatable, makes excellent winter and early spring growth, and has high production. Annual ryegrass affords strong competition for the perennials used in the same mixture, so that the ryegrass should be seeded sparingly (1 pound or less to the acre). If it is desired to thicken the cover after the perennials have become established, this may be done by broadcasting the annual ryegrass seed over the pasture. Seed is available.

California or Mountain Bromegrass (7)—This is a tall, erect bunchgrass, moderately leafy. It is resident throughout most of the state as a short-lived perennial, or as an annual where the rainfall is low. It is a winter and spring grower. Mountain bromegrass (*Bromus marginatus*) is often impossible to distinguish from California bromegrass (*B. carinatus*) because of intergrading types. In areas where California brome is adapted, commercial seed of mountain brome will usually give a satisfactory performance. Seed is commercially available.

Harlan Brome (100)—Harlan brome originated in the University grass gardens in Berkeley, and was presumably introduced from Chile where it is native.

It is a palatable, aggressive plant. Because it is a short-lived perennial, it will act as an annual under unfavorable conditions. However, it reseeds well, and thus maintains itself on ranges where it is adapted. It has been observed to set seed on stems only 2 inches in height. Harlan brome will probably be used to supplement some of the domestic ryegrass currently being used to seed the range, especially in the 25- to 30-inch rainfall belt. It has done particularly well in the Wooden Valley area of Napa County. A winter and spring grower, it is available commercially in limited amounts.

Perennial Ryegrass (14)—Perennial, or English, ryegrass is fully as palatable as domestic, bears more basal leafage, but does not produce so high a yield. It is desirable because it grows later in the summer. This grass is no longer used in some areas (notably the central coast) because of rust injury. Seed is commercially available.

Prairie Brome (25)—This strain was first grown in California at the Meloland Experiment Station of the University of California, in the Imperial Valley, from seed obtained from New Zealand.

Prairie brome, a medium-tall, leafy bunchgrass, is a strong winter grower. It has performed particularly well on coastal ranges, and elsewhere on good soils with 20 inches of rainfall or more. It is definitely distinct from and superior, in California, to any of the "rescue-grasses" of the southwestern United States, with which it has been compared. Prairie brome seed is available commercially.

Soft Chess—This is the principal annual bromegrass throughout the Sierra foothills, Great Valley, and Coast Range of California. It came into the state with the flocks and herds of Father Serra in the early Mission Period, as did bur clover and other annuals. Soft chess is of major importance for range forage. It is palatable at all stages of growth, and usually retains many nonshattered, nutritious seeds on the mature, dry plants. If seed were available, this species would replace ryegrass as the desirable annual to be used in mixtures on chamise burns.

LEGUMES

Bur Clover (20)—A winter annual, this legume is common to most range areas except the granitic soils in the Sierra foothills on the east side of the San Joaquin Valley. It is one of California's most valuable resident legume range species. The green plants of winter and spring as well as the dried plants and burs of summer are valuable high-protein feed. Bur clover does not usually require seeding except where natural stands have been eliminated by cultivation, spraying, or encroachment of brush. Seed is available commercially.

Crimson Clover (101)—This is a winter annual legume that is readily distinguishable by the bright crimson color of the blossoms. Although it is not a heavy producer under California range conditions, it has demonstrated an ability to reseed itself. It has performed particularly well in the intermediate elevations of the Sierra. Seed is commercially available.

Rose Clover (102)—The foundation seed of rose clover, a winter annual, is derived from an introduction from Turkey. It appears to be less sensitive to low temperatures and fewer hours of daylight than either bur clover or subclover, and therefore grows more rapidly than either of them in cool weather. It prefers well-drained soils. It has done particularly well on the reddish soils and granitic soils in the Sierra foothills.

Rose clover is a true clover. It has the widest adaptation of any range legume tried in California, and will supplement bur clover where it is difficult to obtain satisfactory stands or growth of the latter. This clover remains green one or two weeks longer than midseason subclover, and is especially useful on poor soils that are slightly acid, such as those in zones 1, 4, and 5. It is also doing well in bur seedings in zones 2 and 3. Seed is now available commercially.

Spanish Clover—This is a native, annual legume that in some years provides an abundance of good summer feed. It flowers from May to October. This and related species are widely distributed in California, and are found in the open areas of brush fields. It has not been tried extensively in brush burns. Seed may be available in certain years.

Subterranean Clover or Subclover—This annual has climatic preferences and a growth season similar to those of

bur clover. The plant is low-growing, soft, and woolly, all parts being covered by fairly long, soft hairs. Each leaf is formed of three heart-shaped, faintly toothed leaflets, and is carried on a long stalk. After seeds form, the stems bend down and grow until the seed head is pushed into the soil. Subclover does well in acid soils if enough phosphorus is available. In coastal areas north of Carmel, and in the Central Valley, a mixture of Mt. Barker and Tallarook generally succeeds.

The Mt. Barker strain (midseason, 56) is generally used although Tallarook (late season, 98) is also doing well on the north coast. Early Dwalganup (97) should be retested for adaptation in areas of rainfall of less than 15 inches. Seed of Mt. Barker and Tallarook strains is available commercially. An additional 40 strains have been tested by the Agronomy Division for two years, at Davis and in Humboldt County. Hills Small and Samaria look very good. Undoubtedly new strains will appear on the market in the future. Subclovers are noted for their ability to produce seed under conditions of heavy grazing.

Sweetclovers—Both yellow blossom sweetclover (61) and white sweetclover have survived in tests in most areas of California. The latter has been observed growing on raw earth cuts under very adverse conditions at elevations up to 5,000 feet. In general, however, the palatability of the sweetclovers in the fresh, green state is low, and they are not readily grazed unless there is a shortage of feed. The sweetclovers are biennials, but do not reseed themselves under range conditions.

Madrid yellow sweetclover (61A) appears to be the best variety for California conditions.

OTHER SPECIES

Filaree—There are three common species: Cutleaf or Redstem, Whitestem, and Broadleaf. At least one species will usually be found on most California ranges. All three are annual herbs of the geranium family and are considered good stock feed, either green or dry, since the plants are usually high in protein. The resident seeds germinate with the fall rains, providing late winter and early spring green feed. The plants usually mature by the first of June, and dry up. Redstem is considered the best forage species of the three. Ordinarily, it will not be necessary to include filaree in range seed mixtures since it volunteers readily. It might be included in seed mixtures being sown on reclaimed brush fields in instances where prior examination has shown that the brush has choked out most resident forage species. Seed is commercially available from time to time.

STEP 3: CONTROL OF GRAZING

The third phase of a planned program to change brush-covered areas into productive grasslands—the control of grazing—is of much importance. Without it, both the process of clearing brush from the land and the revegetation of such areas will fail of complete economic success.

To carry out this part of the threefold plan for improving range lands, the rancher should give much time and thought to the following four factors:

1. Adjust grazing practices. On any ranch this is usually desirable.

2. Plan a long-term grazing program. The rotational grazing plan, herein described, calls for dividing the range into fenced or controlled fields.

3. Discontinue grazing before burning or reburning an area to provide a mat of dry grass to carry the ground fire.

4. Graze a newly seeded burn area *after* the forage plants have matured—set seed and begun to dry up.

Grazing Management Is Important

Adjusted grazing is essential to insure permanent stands of forage. On most ranges, in fact, whether or not they have been burned off and converted to grasslands, planned grazing has been found desirable.

In general, seeded plants adapted to an area will survive and flourish under the same grazing practices that serve to improve the natural vegetation. On the other hand, they will gradually be eliminated by the same practices that tend to destroy the best species of natural forage plants.

When the rancher opens new range areas by the removal of brush, he has both an added responsibility and an improved opportunity to produce more meat and wool: he can make adjustments that will not only increase feed resources but also prolong the season of grazing.

Proper seasonal use of the range should lie somewhere between continuous close cropping, which weakens and gradually removes the desirable annuals and perennials, and too light grazing, which tends to build up a heavy litter and increase the undesirable, weedy annuals.

Planning the Long-term Grazing Program

No fixed rules can be outlined for a range domain such as California, with its wide variations in climate, soil, and elevation. A grazing-management plan must be based on individual ranch conditions; the type and abundance of forage plants and their distribution over the given area; and the practical necessities, such as cross-fencing and providing stock-watering facilities.

Obviously, the seasonal green feed produced by winter rains should be converted into meat and wool while at its best. On the other hand, the perennials and better late-maturing annuals (such as bur clover and soft chess) should be allowed to set some seed, and thus increase their percentage in the forage. This requires a balanced grazing program.

Outlining the Program. For the most effective over-all operation, the rancher should not burn, in any one season, an area larger than can be placed under controlled grazing, to assure a permanent revegetation.

To establish growth of forage on burns, there should be no grazing the first spring until the perennials have set seed. It has been found that perennials and desirable annuals can be maintained better under a system of seasonal rotational grazing (table 4).

The successful operators, who have followed a brush-control program for five years or longer, have made their range subdivisions correspond roughly with the areas to be burned. Topography or watering facilities or north and south slopes may keep this plan from being copied precisely, but a good brush-control program should follow it as closely as possible.

Seasonal Rotation Grazing. A three-year rotation plan has been found practical to apply and effective in improving the range.

In carrying out such a plan, the rancher divides his range area into at least three fields, either by actual fencing and cross-fencing, or by herding and drift-fencing to keep stock from certain portions of the range. The plan must also include adequate watering facilities in each field. This is how the plan works:

The first year, the rancher grazes field number 1 early, and removes the stock before the surface soil moisture is exhausted in the spring, keeping the animals in the other fields.

The second year, he applies the same treatment to the second field, using the first and third fields for later grazing.

The third year, he applies this practice to the third field, turning the animals then into the first and second fields.

Such a grazing cycle should serve to

TABLE 4—Main Types of Range Forage Plants, Their Growth Characteristics, and Grazing-management Requirements

Plants	Long-lived perennials	Desirable annuals or short-lived perennials	Weedy annuals
TYPE:			
Grasses	Harding, stipa, tall fescue, California oatgrass, smilo	Ryegrass Soft chess Mountain brome	Foxtail Ripgut
Legumes	Alfalfa Birdsfoot trefoil	Bur clover, rose clover, sweetclover	
CHARACTERISTICS:			
Seedling development	Very slow	Fairly rapid	Rapid
Ability to compete first year	Poor	Good	Excellent
Seasonal use	Green early in fall, mature late in spring	Intermediate	Mature early; obnoxious when ripe
MANAGEMENT REQUIREMENTS:			
To establish on burns	No grazing first spring and summer	As for perennials	
To maintain	Seasonal rotation system of grazing (see text, p. 30)	As for perennials	
To reduce			Graze or mow in early spring to prevent seeding

keep a proper balance of forage species in all three fields, although certain factors complicate a too-rigid application of this scheme. For example: the feed on north slopes is green later in the spring than that on exposed south slopes; and on swales and seeps, the feed remains green much later. Thus, in planning cross-fencing and stock-watering facilities, these topographic factors, as well as the varying plant populations peculiar to them, must be taken into account.

A knowledge of range forage plants will aid the operator in managing grazing areas. Table 4 should prove helpful; it lists examples of long-lived perennials, desirable annuals or short-lived perennials, and weedy annuals, as well as their characteristics and management requirements under grazing conditions.

General view of artificially seeded area in burn near Weed, Siskiyou County. This brush field was burned in the fall of 1939, and the ridgetops were seeded to crested wheatgrass, ryegrass, tall oatgrass, and smooth brome. The latter two are prominent in the picture. (Photographed June 24, 1942.)

BURNING OPENS GOOD SEED AREA

DOES NOT KILL NATIVE PLANTS

Same field as shown in picture above. The native bunchgrass is western stipa. The plants were not killed by the fire. A 6-inch rule is at base of stipa plant in right foreground. (Photographed June 24, 1942.)

Value of Grazing Periods Shown

To Aid in Elimination of Brush. If fire is to be used to clear brush from the land, the selected area should not be grazed at all during the year it is burned. This treatment (p. 34) will provide an understory of grasses to help carry the flames and make a clean burn. This also applies to reburning.

To Establish Forage. Time and intensity of grazing should be determined by the percentage stand of annual grasses in the mixture.

If annual grasses, such as ryegrass, predominate, the freshly seeded area should be subjected to an intensive grazing for a short period just before the ryegrass begins to head out. The grazing should be severe enough to retard the ryegrass. Livestock should be removed before the last spring rains. The perennials, such as hardinggrass, will then continue to develop and produce some seed.

If perennials predominate, and this is desirable for a first-year stand on a seeded burn, stock should be kept off the freshly seeded area at least until the grasses have begun to set seed. Possibly grazing should be deferred until the fall rains, as the plants may be poorly rooted where ash was abundant in the seedbed. A grazing in the fall will serve to trample the new seed crop into the soil and help thicken the stand.

The value of adjusted grazing in a seeded area was demonstrated north of Weed, Siskiyou County. An area of 3,000 acres there was burned in the fall of 1939; the ridgetops were seeded to crested wheatgrass, perennial ryegrass, tall oatgrass, and smooth brome. This acreage, together with an additional 2,000 acres not burned, has been carrying 700 head of cattle from November 1 to May 1 of each year. Confining the grazing to that period has resulted in an increased stand of seeded species (see top photo, opposite page) even in this area of low rainfall (approximately 12.1 inches annually). It was also significant that the fire did not kill the native bunchgrass (see bottom photo, opposite page).

To Maintain Forage. An area that is burned or reburned should not be grazed until the next year (June to August, varying with local conditions); then perennials will have a chance to develop and mature seed (table 5).

TABLE 5—Recommended Grazing Management for Area to Be Cleared of Brush.

FIRST YEAR	Keep stock off. Burn in summer. Seed burned area if necessary.
SECOND YEAR	If perennial grasses predominate, graze after they have set seed, whether artificially seeded or not. If annual grasses predominate, graze heavily for a short period before the last spring rains. Remove stock before soil moisture is exhausted.
THIRD YEAR	Graze early. Remove stock before soil moisture is exhausted.
FOURTH YEAR	Keep stock off all year. Reburn in late summer. Reseed certain areas if necessary.
FIFTH YEAR	Treat as in second year.
SIXTH YEAR	Treat as in third year.

A seasonal rotation grazing system (see p. 30) will help maintain the forage plants at a maximum level consistent with high returns in animal products.

To Help Destroy Brush. Grazing animals readily take brush sprouts and seedlings during the summer period. Therefore, the summer following the fire, livestock will kill some of the brush at the time the seeded forage plants are dry.

Reburning Aids Brush Control

For effective control of sprouting brush, two or more fires appear to be essential unless machinery is used. Numerous brush seedlings often become established following fire. Many species sprout from the crown. The area should be reburned before the seedlings reach maturity and produce a crop of seed. The time interval varies with species and climate, but in general, reburning may be required in from two to five years after the first burning for brush removal. The second burn will kill some more sprouting plants and many brush seedlings.

Method of Reburning. On any burn, most satisfactory results are secured from a continuous ground fire. The area should be left ungrazed the year it is to be reburned, as a good mat of dry grass will carry an effective ground fire and is the best known means of doing a good job. Though such a fire should be amply protected to keep it from escaping, it is less risky than the original burning of either standing or bulldozed brush. A permit for burning must be obtained from the forest ranger or local fire-control agency.

Reburning two or three times at two- to five-year intervals will neither greatly reduce the annual plants nor seriously injure perennial grasses and legumes. An area to be reburned in the fall should not be grazed until the following summer, after the perennial grasses have matured their seeds. This results in more total feed, and a thickening of the stand of grasses.

It has been found that if the burned brush is largely of the sprouting type, such as chamise and certain species of manzanita, sprouts will emerge from the crowns the year after the first burning. Only in a very hot fire will the crowns be entirely killed. The nonsprouting forms will have cast an abundant crop of seeds, and some of these, such as wild lilac and mountain balm, will germinate readily after a burn.

The sprouting forms will generally begin to produce seed by the third year, and seedlings from both sprouting and nonsprouting forms will produce seed by the fifth year. A good ground fire in a second burning should destroy the seedlings that have come up since the original fire. It will also kill the crown sprouts and further weaken the roots and crowns of the sprouting shrubs.

Goats have often been used to complete the eradication of brush by browsing upon young sprouts. Deer, and even cattle and sheep, relish the shoots of many species.

Desirability of Reburning. Failure to reburn may result in economic loss, as an example in western Colusa County illustrates. In 1946, a small area with a dense stand of chamise was burned. In addition to trial plots, several acres were seeded to a mixture of grasses and legumes (see discussion, p. 14). Many of the species did very well the first year. In 1950, however, it was evident that the regrowth of sprouting chamise and the encroaching brush seedlings should be reburned if the smilo plants were to survive. Since this was not done, some of the benefit of the first burning was lost through regrowth of the chamise (see opposite page, top photo).

The value of reburning, on the other hand, was demonstrated on a ranch north of Hopland in Mendocino County. The brush there included chamise, wild lilac, cascara, manzanita, scrub oak, and toyon. There was a sparse cover of pinegrass, purple stipa, and foothill stipa, as well

Regrowth of chamise four years after the initial burn. There is a fair stand of smilo scattered through the brush, but failure to reburn will allow the chamise to take over the site again. (Photographed March 8, 1950.)

FAILURE TO REBURN

LOSES THIS DIVIDEND

Volunteer recovery of grasses one year after a reburn near Hopland, Mendocino County. Envelope in foreground is at base of foothill stipa plant. (Photographed June 12, 1942.)

as a number of other perennial grasses including certain fescue grasses, perennial bluegrasses, and melicgrasses, and a good population of annuals.

The ranch consists of 3,000 acres, 100 of which were burned in 1937. In 1941, these 100 acres were reburned, with an additional 50 acres of new burn. The lower photo on page 35 shows the stand of foothill stipa in this area in 1942. Pinegrass invaded the poorer soil sites. The ranch now grazes 900 to 950 ewes, their lambs, and an undetermined deer population. It must be emphasized that brush burning was only part of the conversion from brush- to grassland. Ten years ago, the range was divided into only two fields. Now, in the 3,000 acres, there are seven fields with stock-watering facilities well distributed in each. Grazing management, except for the deer, is well regulated.

APPENDIX

The following list includes common and scientific names of shrubs, legumes, grasses, and herbs mentioned in this circular, with key numbers of those used for seeding, and estimated seed numbers on a per-pound and per-square-foot basis.

Common name	Scientific name	Key number*	Approx. no. seeds per lb. (in thousands)	Approx. no. seeds per sq. ft., broadcast at 1 lb. per acre
Alfalfa				
Common or Chilean	Medicago sativa	17	220	5.0
Ladak	M. sativa var. Ladak	18	220	5.0
Birdsfoot trefoil	Lotus corniculatus			
Broadleaf, or erect	.....	15	500	11.5
Narrowleaf, or prostrate	.....	16	500	11.5
Bluegrasses	Poa spp.			
Bromegrass				
California	Bromus carinatus			
Cucamonga	B. carinatus var.			
Harlan	B. stamineus	100	72	1.7
Mountain	B. marginatus	7	142	3.2
Prairie	B. catharticus	25	68	1.6
Smooth (Lincoln strain)	B. inermis	64	137	3.0
Bur clover	Medicago hispida	20	209	4.8
Burnet	Sanguisorba minor	30	90	2.3
California oatgrass	Danthonia californica	9	145†	3.3
Cascara	Rhamnus purshiana			
Cereal rye	Secale cereale		18	0.4
Chamise	Adenostoma fasciculatum			
Coastal sage	Artemisia californica			
Crimson clover	Trifolium incarnatum	101	140	3.0
Digger pine	Pinus sabiniana			

* Numbers are those assigned to the varieties used in range trials throughout the state.
† Low germination.

APPENDIX—(*Continued*)

Common name	Scientific name	Key number*	Approx. no. seeds per lb. (in thousands)	Approx. no. seeds per sq. ft., broadcast at 1 lb. per acre
Fescue	Festuca spp.			
Chewings	F. rubra var. commutata	11B	615	14.1
Creeping red	F. rubra	11A	615	14.1
Tall:	F. arundinacea			
Alta		8	227	5.2
Goar		8B	227	5.2
Kentucky 31		8A	227	5.2
Filaree	Erodium spp.		240	5.5
Foxtail	Festuca spp.			
Hardinggrass	Phalaris tuberosa	28	350	8.0
Highland bentgrass	Agrostis tenuis	112	9,072	208.3
Live oak	Quercus wislizenii			
Lomasgrass	Elymus glaucus	113	137	3.0
Manzanita	Arctostaphylos spp.			
Melicgrasses	Melica spp.			
Mountain balm	Eriodictyon spp.			
Oak	Quercus sp.			
Oats	Avena sativa			
Orchardgrass	Dactylis glomerata			
Common		63	590	13.9
Akaroa		63A	590	13.9
Pinegrass	Calamagrostis rubescens			
Poison oak	Rhus diversiloba			
Redtop	Agrostis alba	105	4,990	114.5
Ripgut	Bromus rigidus			
Rhodesgrass	Chloris gayana	67	1,700†	39.0
Rose clover	Trifolium hirtum	102	177	3.9
Ryegrass				
Annual	Lolium multiflorum	13	227	5.2
Perennial	L. perenne	14	330	7.5
Scotch broom	Cytisus scoparius			
Scrub oak	Quercus dumosa			
Sherman big bluegrass	Poa ampla	103	882	20.2
Smilo	Oryzopsis miliacea	26	1,000	23.0
Soft chess	Bromus mollis			
Spanish clover	Lotus americanus			
Stipa	Stipa spp.			
Foothill	S. lepida	33		
Nodding	S. cernua	34	224	5.1
Purple	S. pulchra	35	108	2.5
Western	S. occidentalis			
Subclover	Trifolium subterraneum			
Early Dwalganup		97		
Mt. Barker		56	72	1.6
Tallarook		98	55	1.2

APPENDIX—(*Continued*)

Common name	Scientific name	Key number*	Approx. no. seeds per lb. (in thousands)	Approx. no. seeds per sq. ft., broadcast at 1 lb. per acre
Sudangrass	Sorghum vulgare var. sudanense			
Sweetclover	Melilotus spp.			
Madrid yellow blossom	M. officinalis var. Madrid	61A	250	5.7
Yellow blossom, common	M. officinalis	61	250	5.7
Tall oatgrass	Arrhenatherum elatius			
Common	.....	6	150	3.4
Tualatin	.....	6A	150	3.4
Timothy	Phleum pratense	106	1,200	27.5
Toyon	Photinia arbutifolia			
Veldtgrass	Ehrharta calycina	91, 91A	531†	12.3
Vetch	Vicia sativa		8	0.1
Wheatgrass	Agropyron spp.			
Crested	A. desertorum	1	193	4.4
Intermediate	A. intermedium	109	88	2.0
Pubescent	A. trichophorum		100	2.3
Slender	A. pauciflorum	4		
Tall	A. elongatum		79	1.8
Western	A. smithii	2	110	2.5
Wild buckwheat	Eriogonum spp.			
Wild lilac	Ceanothus sp.			
Yerba Santa	Eriodictyon spp.			

ACKNOWLEDGMENTS

The authors wish to thank the Farm Advisors of California and the many livestock men whose interest and active coöperation made it possible to obtain much of the information included in this circular.

The lower photo on the cover was provided by Mrs. G. F. Lineer, San Francisco.

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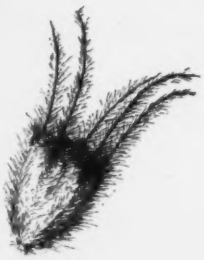
Exhibit #11

ROSE CLOVER

A NEW WINTER LEGUME

R. MERTON LOVE
DORMAN C. SUMNER



CALIFORNIA AGRICULTURAL
Experiment Station
Extension Service

CIRCULAR 407

ROSE CLOVER . . .

is an annual winter legume recently introduced and tested throughout California. It will grow and thrive on soils that will not support good growth of bur clover or subclover. Seed is available commercially.

One seeding . . .

in the fall establishes the crop. On soils of low fertility, the first-year stand of rose clover may be sparse, and the growth poor, but invariably it increases in density and production. It reseeds and volunteers year after year.

As a soil builder . . .

it is excellent. It prepares the way for other legumes and grasses.

PLANT ROSE CLOVER

PAGE

On Annual Type Ranges 8
On Brush Burns 10
On Grain Land 10
On Abandoned Grain Land . . . 11

The cover picture shows a mature plant of rose clover at approximately one third the height it reaches when full grown in good soil. At the lower left is a seed pod (calyx) of rose clover, approximately 4 times actual size. (All drawings by Mrs. Gertrude Julian.)

The Authors:

R. Merton Love is Professor of Agronomy and Agronomist in the Experiment Station, Davis.

Dorman C. Sumner is Assistant Specialist in Agronomy, Davis.

ROSE CLOVER

A New Winter Legume

R. MERTON LOVE and DORMAN C. SUMNER

In 1949, after five years of range plot trials in 15 counties, seed of rose clover was made available commercially in California. Since then, this legume has become as well known as many of the old, standard forage crops, such as bur clover and filaree.

Rose Clover Is Adaptable . . .

It will grow in soils where practically no other plants survive, and will even provide some forage under such unfavorable conditions.

In Central Europe, rose clover is described as growing "in dry, sterile fields, on slopes, on sandy steppes, on roadsides, in waste places in the Mediterranean region. . . ." It has been observed in the area north of the Mediterranean from southwestern to southeastern France, across to Trieste, in Serbia, and elsewhere in Europe and Asia Minor.

In California, so far as the writers know, rose clover has been successful on all acreage seedings, and such seedings have been made in almost every zone of the state. (See table 1, p. 4.)

Livestock Like It . . .

Cattle, sheep, and deer appear to graze rose clover well even when it is completely dried up. It is also well liked by doves and quail.

No palatability studies have been conducted, but observations throughout the state show that sheep and cattle graze rose clover as readily as they do other annual clovers. A significant observation in Santa Clara County is worthy of mention. A series of plots had been seeded side by side. After three years, rose clover had invaded the subclover plots. The rose clover-subclover area was grazed much more closely by cattle than was the subclover area. According to the Farm Advisor, after rose clover had been growing for two years in a 1½-acre field, grasses appeared again. When horses were turned into the field, they avoided the grasses and grazed the rose clover first. Close grazing does not seem to force rose clover back.

Little is known about the nutritive value of rose clover, but it appears to be comparable with that of other legumes. Protein content of rose clover is slightly less than that of bur clover at similar stages. Rose clover samples had a protein content of 24.9 per cent when lush and green, compared with 27.0 per cent for bur clover. At the flowering stage, 12.6 per cent protein in rose clover may be compared with 15.0 per cent for bur clover. Dead, dry rose clover plants have 8.0 per cent protein, and those of bur clover, 13.9 per cent. (The figures for bur clover are averages obtained from Professor Harold Goss, Division of Animal Husbandry, and are not directly comparable with those for rose clover, but will serve as a general comparison.)

Samples cut in May, from a mixed planting in a phosphated field in Sacramento County, showed the following protein contents: rose clover, 12.6 per cent; crimson clover, 16.7 per cent; and subclover, 17.3 per cent.

Trial Plots Proved Its Worth . . .

In 1944, the Division of Agronomy received small amounts of seed of annual legumes from the United States Depart-

Fig. 1—A very small plant of rose clover, about 2 inches high, that developed in an unfavorable location in the Blue Mountain burn, Shasta County. Compare with Figure 2. (Seeded fall, 1950; photographed August, 1951.)

ment of Agriculture at Beltsville, Maryland. Among these was a packet of rose clover seed. This sample came from Turkey, and was given the U.S.D.A. accession number F.C. 23,104. In California, its range trial key number is 102.

The first trial plantings were made in the fall of 1944, in cooperation with the Agricultural Extension Service. These consisted of 25 range plots in 15 counties. Reports received by the Division of Agronomy in 1945 are shown in Table 1.

Rose clover reseeds itself. A high percentage of each year's crop of seed is hard. Therefore, not all seeds will germinate when the first fall rains come, and some may remain in the ground for a year before germination takes place. Rose clover has the ability to produce some seed under extremely unfavorable conditions (fig. 1). This reseeding ability is important, as shown by the fact that some of the test plots rated "poor" in the 1944 trials were rated "excellent" by 1946. This may have been partly because the hard seed from previous years began to grow. The "excellent" rating in these plots was maintained through the four severe winters 1946–1949, and rose clover plants were also showing up in other parts of the fields, beyond the test plots. Percentage of hard seed in nine samples of rose clover is shown in Table 2.

Table 1. Performance Rating of Rose Clover in 15 California Counties, 1945

Zone*	County	Number of plots	Performance	Rank†
1	Mendocino	2	Good, Fair	1st
	Trinity	1	Fair	1st
	Lake	1	Fair	1st
2	Santa Clara	1	Fair	2nd
	Santa Cruz	1	Fair	2nd
	Monterey	1	Poor	3d
3	San Diego	5	Good (4), Fair (1)	1st (1), 2d (3), 3d (1)
4	Amador	2	Good, Poor	1st (1), 2d (1)
	Calaveras	2	Good, Poor	1st (1), 3d (1)
	Nevada	2	Good, Fair	1st
	Butte	2	Good, Fair	2d
	Sacramento	1	Good	1st
5	Mariposa	2	Good	1st
6	Sierra	1	Fair	1st
	Plumas	1	Good	1st

* See map, page 6, for planting zones.
† In comparison with bur clover and subclover.

Table 2. Hard Seed Content in 9 Samples of Certified Rose Clover Seed

Year	Germination	Hard seed	Total viable seed
	per cent	per cent	per cent
1949	67.50	20.75	88.25
	49.50	36.50	86.00
1950	69.50	24.75	94.25
	64.00	30.25	94.25
	60.75	32.50	93.25
	44.00	48.00	92.00
	44.50	48.50	93.00
	48.00	33.50	81.50
	61.50	35.00	96.50

Certified seed is available. On the basis of the trial performances, the California Crop Improvement Association certified the seed increase of rose clover. A 50-pound lot of F.C. 23,115 (the progeny of F.C. 23,014) was obtained from the U.S.D.A. in November, 1947, and used as foundation seed. The first certified increase field of rose clover in the state was planted in Madera County in February, 1949. Sixteen acres were seeded, and produced 420 pounds of certified seed per acre. The grower increased his planting to 71 acres the following year, and produced 316 pounds per acre. Thus, in 1950, more than 11 tons of pure seed were available to ranchers, and by 1951, about 33 tons. (There are approximately 177,000 seeds in a pound of rose clover, as compared with 220,000 for alfalfa, and 140,000 for subclover.)

How much of this certified seed was planted is not definitely known, but acreage seedings were made in a number of counties. In Shasta County, a seeding of 4,400 acres on a control burn in 1950 included rose clover in the seed mixture (fig. 2). In Butte County, another seeding on a control burn of 1,000 acres also had rose clover in the mixture. Both were very successful. Other acreage seedings were made in almost every zone in the state.

In so far as the writers know, rose clover has not failed wherever it has been planted in acreage seedings. During the trial period there were two failures, both in small plot trial seedings. In Monterey County, near San Lucas, no stand was obtained the first year, and in Tehama County, near Corning, a good first-year stand did not volunteer the second year. Reasons for these failures are not known.

What Rose Clover Looks Like

The scientific name for rose clover is *Trifolium hirtum* All. It is a many-

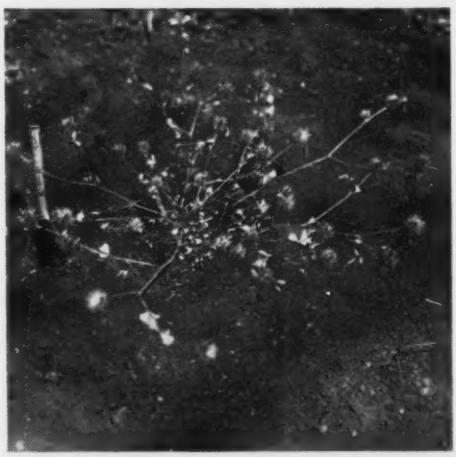
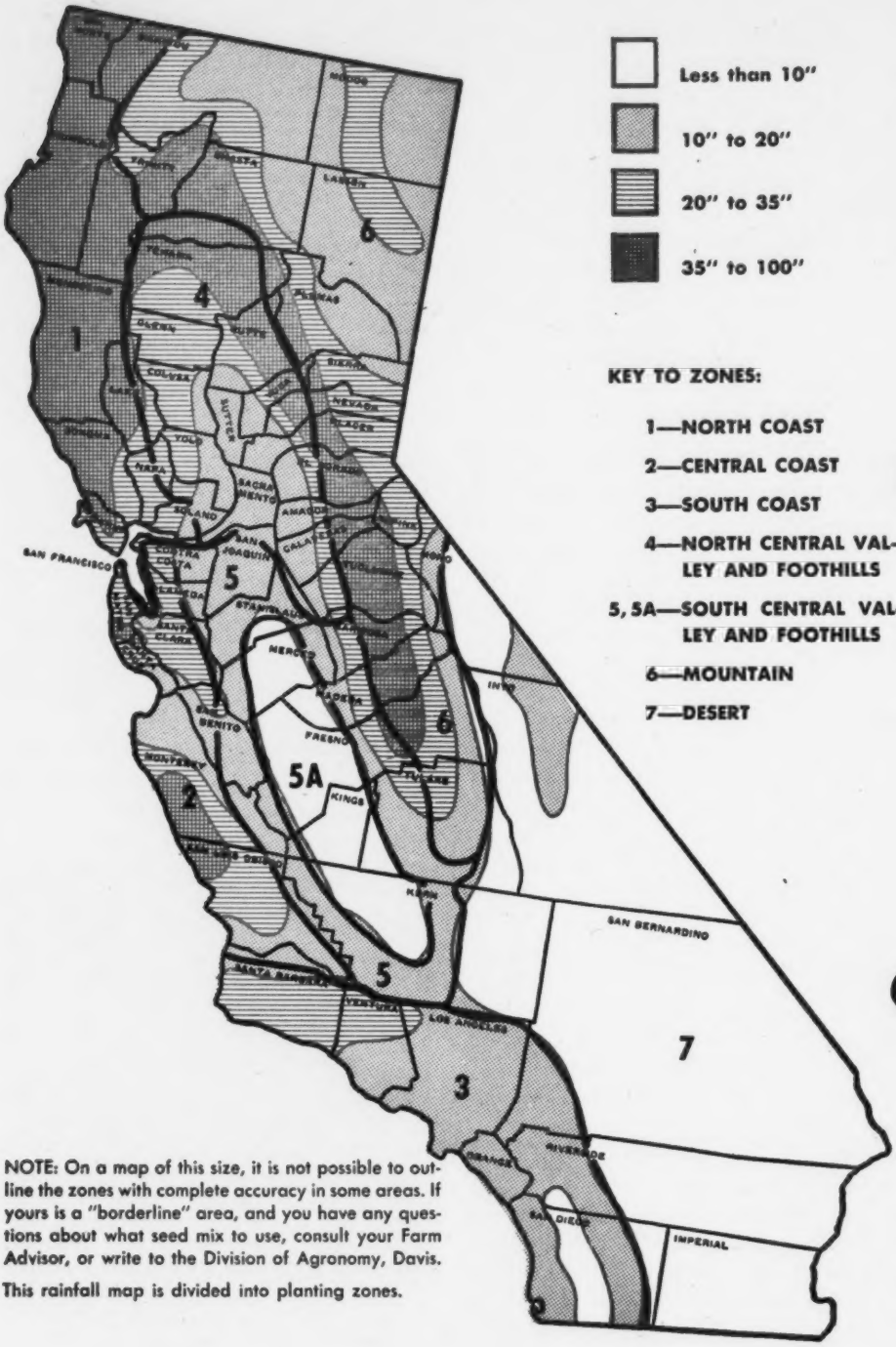


Fig. 2—Rose clover responds to favorable conditions by putting on more growth. This plant is in the same area as that shown in Figure 1, but on a different site. (Photographed August, 1951.)

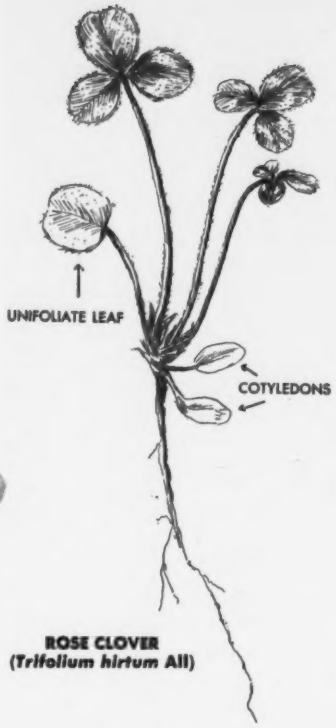


NOTE: On a map of this size, it is not possible to outline the zones with complete accuracy in some areas. If yours is a "borderline" area, and you have any questions about what seed mix to use, consult your Farm Advisor, or write to the Division of Agronomy, Davis.

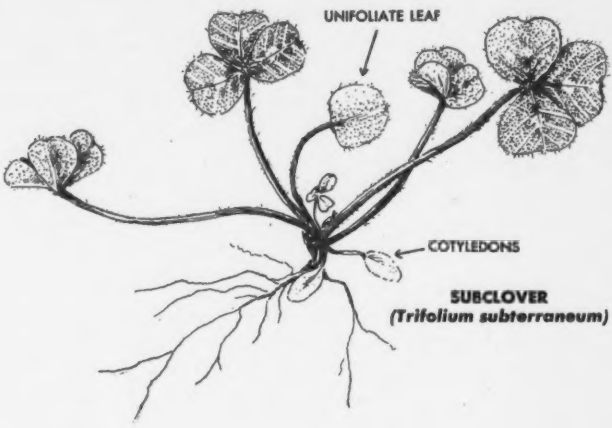
This rainfall map is divided into planting zones.

CLOVER SEEDLINGS

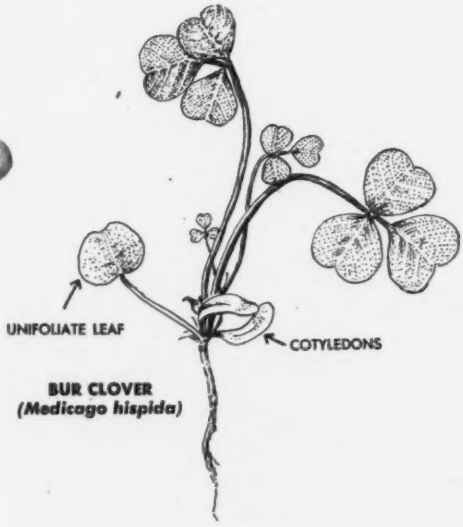
Fig. 3—The drawings on this page will aid ranchers and others in identifying the young plants of the annual clovers most commonly used in range seedings.



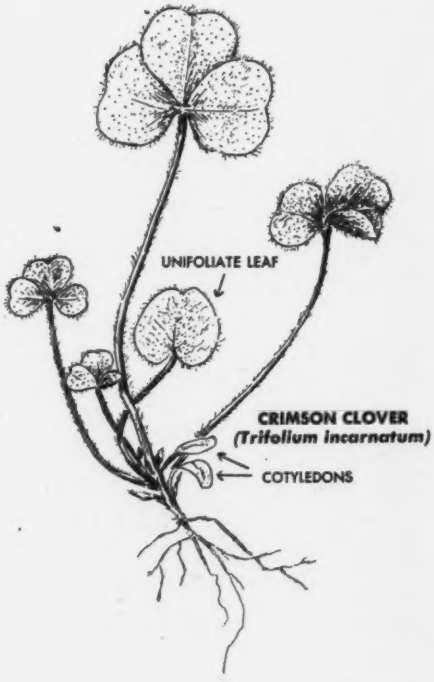
ROSE CLOVER
(Trifolium hirtum All)



SUBCLOVER
(Trifolium subterraneum)



BUR CLOVER
(Medicago hispida)



CRIMSON CLOVER
(Trifolium incarnatum)

branched, winter annual legume that grows from 3 to 18 inches high (fig. 2). The spreading branches are densely covered with short, coarse hairs. As with most true clovers, each leaf has three leaflets at equal distances from the end of the leaf stalk, the center one somewhat larger than the other two. These leaflets are about the size and shape of those on bur clover, have a scattering of short hairs over both surfaces, and usually a small, reddish mark a little above the center. The leaf stalks are from ½ to 2 inches long, and have hairs like those on the leaflets. At the base of the leaf stalks are hairy stipules ¼ to ½ inch long, with smooth margins and long, tapering points. The flower heads are rose-colored, spherical, about ¾ inch across, and profusely covered with stiff, white hairs. A leaf with somewhat smaller leaflets grows directly from the base of the flower head, and the stipule of this leaf cups up around the base of the head in a manner similar to that of red clover. The seed is yellowish, smooth, a little over 1/16 inch long, with a scar on the end. Very faint lines on the seed, that meet at the scar end, can be seen with a hand lens.

Plant Rose Clover On Annual Type Ranges . . .

Seedbed preparation. Treat the seed with a general *Trifolium* (true clover) inoculant just before planting. Plant in the fall for best results (fig. 4). A minimum of seedbed preparation is required. Apply 100 to 300 pounds of single superphosphate per acre; disk the field before the fall rains. After seeding, roll the area with a ringroller or cultipacker.

If you follow these directions, you will have good results: (1) the seedbed will be firm; (2) seed will be covered with a light mulch of soil and organic matter; (3) young plants will have a ready source of phosphate, necessary for maximum growth; (4) nitrogen-fixing bacteria will be present for nodulation of the roots.

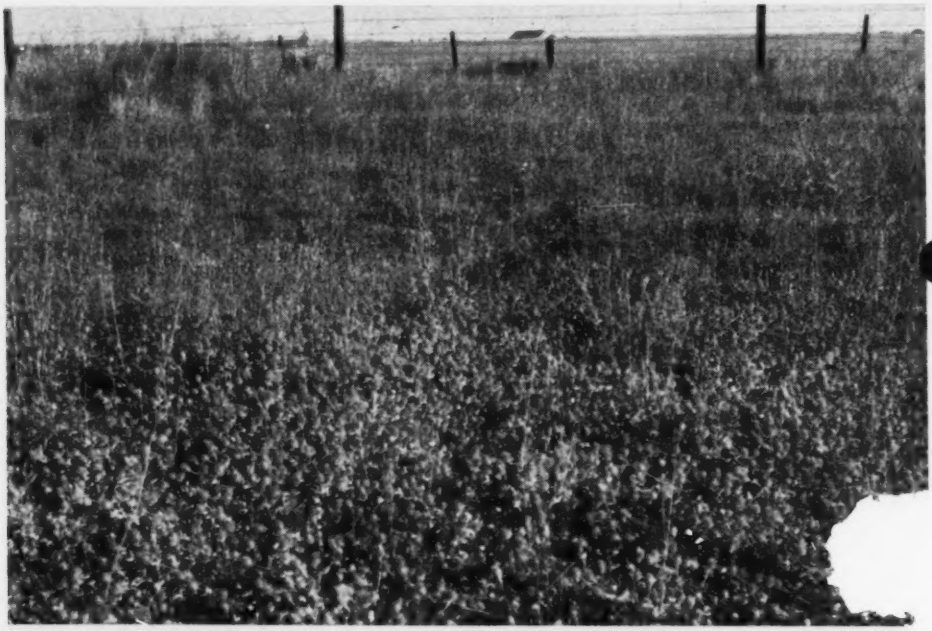


Fig. 4—Rose clover was seeded in early October, 1950, at 2 pounds per acre. Single superphosphate was applied at 200 pounds per acre, following a dry disking. A good stand developed. Area is near Wheatland, Placer County. (Photographed May 21, 1951.)

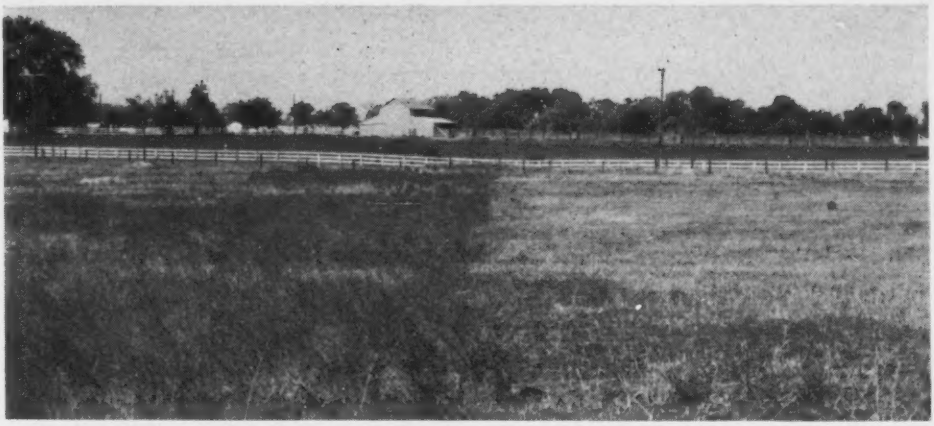


Fig. 5—Left, freshly disked area with abundance of tarweed. Right, six-year-old stand of rose clover has practically eliminated undesirable annuals. Desirable annuals, such as soft chess and even annual ryegrass, are invading the area, which is near Wilton, Sacramento County. (Photographed October 13, 1951.)

Seeding. Use from 1 to 10 pounds of seed per acre. Drill or broadcast the seed. If you are not in a hurry, use the lower seeding rate. An original seeding of 1 pound per acre will generally develop into a solid stand in four or five years. The higher rate should provide a solid stand the second year.

If the soil is extremely infertile and supporting practically no growth of native plants, use rose clover alone. If there is a fairly good cover of native weedy annual grasses and other types, use a mixture of 50 per cent rose clover, 25 per cent subclover, and 25 per cent crimson clover. (Bur clover is not recommended in this original mixture because if it is not already present on a range, it is probably not adapted to the soil conditions existing in that particular annual type range.)

A mixture of winter annual legumes is desirable for two reasons: (1) Seasons vary tremendously in California, and rose clover may do better one year, and subclover another, on the same site. (2) Any field has some soil variation, and rose clover will occupy the poorer soil or better drained areas, while subclover will do well on the better soil or moister sections.

Seasonal use. Graze the area as soon as the weeds and annual grasses are of pasturable height. By that time the cotyledons (seedling leaves) of rose clover will have dropped off, and true leaflets will have formed. The plants will be 2 to 5 inches high. Take care to prevent trampling damage if the soil is too wet.

Grazing may be delayed until late March, after more growth has developed, but if this is done, the field should be grazed heavily for about a month. Recent experience in Placer County showed that 150 Hereford cows and their calves were required to graze satisfactorily a new 50-acre planting in 30 days. That is three animals to the acre for a month.

Whether the field is grazed throughout the winter, or heavily for a shorter period in the spring, three things should be kept in mind: (1) The first objective should be to graze the weeds, both grasses and nongrasses, as closely as possible. (2) Stock should be removed from the field before the last spring rains, to allow the clover plants to recover and set a good seed crop. (3) The more moisture used by the rose clover plants as they mature, the less there will be available for the undesirable summer annuals, such as star thistle and tarweed (fig. 5).

Do not be concerned if the field looks very weedy the first year. This is the result of the initial cultivation, which encourages weed seed germination. The field will take on a cleaner appearance each succeeding year if livestock use is handled as recommended.

On Brush Burns . . .

Include rose clover in the seeding mixture. It grows in the shade of tall grasses (fig. 6). No other range legume has proved to be so well adapted to such a great variety of soil types and climatic conditions.

Use ½ to 1 pound of seed per acre. This is usually adequate when included in a general seed mix, such as harding, smilo, burnet, and alfalfa. Inoculate the seed with a general *Trifolium* inoculant just before mixing with other seeds.

Rose clover will respond favorably to the same grazing treatment as that recommended for established perennials and desirable annuals on a burned area. (See Experiment Station Circular 371, "Improving California Brush Ranges," for detailed recommendations.)

On Grain Land . . .

The only evidence on this use of rose clover is a 50-acre planting near Farmington, San Joaquin County. The seed was planted December 1, 1950, in red oat stubble. No seedbed preparation was made because of wet weather. Single superphosphate was applied at the rate of 500 pounds per acre. Inoculated seed was broadcast by airplane, at the rate of 8 pounds per acre. The rose clover, which was harvested with the oats, yielded 119 pounds of seed per acre.

Fig. 6—Rose clover has performed better than any other range legume in brush burn seedings. Note the dense stand of mature rose clover in the tall harding grasses. Area is near Rescue, El Dorado County. (Seeded by plane October, 1950; photographed July, 1951.)

Fig. 7—Very poor first-year growth of rose clover and other legumes seeded by 2-row range seeder on ranch in eastern Glenn County. Poor growth is common on infertile land. (Seeded November 1, 1949; photographed March 27, 1950.)

Fig. 8—Same field as that shown in Figure 7. Of the mixture seeded, rose clover was the only one showing a marked improvement in stand and growth the second year after seeding, as a result of volunteering. (Photographed May 21, 1951.)

If you wish to plant rose clover with a cereal, use 1 to 10 pounds of rose clover seed per acre. There are two methods for planting: (1) seed the cereal first, then seed the rose clover by airplane; or (2) have an alfalfa drill attached to the grain drill and seed the cereal and clover at the same time.

The advantages of growing rose clover on grain land are: (1) It will do well on soil types that do not support a good growth of bur clover. (2) It will provide a good aftermath feed to supplement the cereal stubble. (3) It will volunteer in succeeding years and add nitrogen to the soil, thus aiding the grain crop.

On Abandoned Grain Land . . .

Give rose clover the same treatment as that described for annual type ranges. Trials and experience generally throughout the state indicate that, to date, rose clover is the best winter annual legume to use to reclaim such land.

Gradually it builds up the soil to the point where it will support more and more growth of desirable forage plants. A striking example is a ranch in Santa Clara County where the soil had become very thin, and would not support vegetation. The soil was improved through use of rose clover, which built up the depleted nitrogen supply.

In Glenn County, 10 species were seeded in the fall of 1949, including four legumes (rose clover, Mt. Barker and Tallarook subclovers, and alfalfa), five grasses (harding, smilo, tall fescue, prairie brome, and tall oatgrass), and burnet. There was a fair stand, but poor growth, of most species the first year (fig. 7). The second year there were a few plants of subclover. But rose clover dominated the picture (fig. 8).

ACKNOWLEDGMENTS

The authors wish to thank Mr. Robert Tofsrud, Division of Agronomy, for the botanical description of rose clover and for the specimen from which the botanical drawing was made, and Mr. James Street, Division of Agronomy, for supplying some of the pictures used in this circular.

6 STEPS TOWARD RANGE IMPROVEMENT

1. ***Seed rose clover or a mixture of annual legumes before the fall rains begin.***
2. ***At the time of seeding, apply superphosphate or soil amendments that encourage legume growth.***
3. ***Graze one subdivision of the range heavily before the annual grasses head out in the spring.***
4. ***Keep stock off the grazed subdivision until fall.***
5. ***Apply steps 3 and 4 to a new field each year.***
6. ***Plan a good pest-control program, with special attention to gophers. Your local Farm Advisor or Agricultural Commissioner can recommend the best methods of control.***

While any grazing-management plan must be based on individual ranch conditions, some form of grazing adjustment is essential to insure permanent stands of forage.

In order that the information in our publications may be more intelligible, it is sometimes necessary to use trade names of products or equipment rather than complicated descriptive or chemical identifications. In so doing, it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

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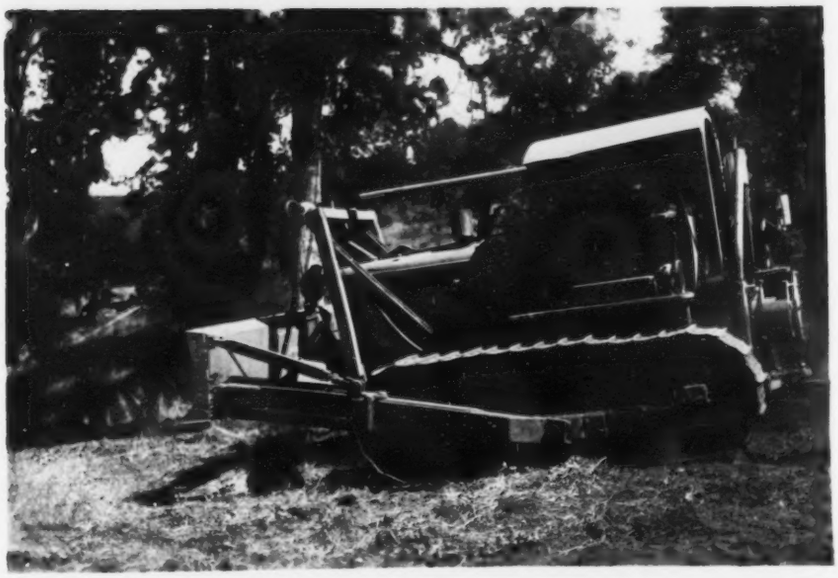
UPPER LAKE DISTRICT
(Deer Creek)

BRUSH REMOVAL METHODS

Fig. 1



Bulldozer.

Fig. 2

Bulldozer with heavy disc.

UPPER LAKE DISTRICT
(Deer Creek)

BRUSH REMOVAL METHODS (Continued)

Fig. 3

Bulldozer and disc in action in chamise and manzanita type.

Fig. 4

Controlled fire - mixed brush.

UPPER LAKE DISTRICT
(Deer Creek)

1948 Project
#48-12

Fig. 1

Photo (1948)
Bulldozer at work. 2 ft.
Los Gatos soil.
Chamise and manzanita.

Fig. 2

Photo (1948)

UPPER LAKE DISTRICT
(Deer Creek)

1948 Project
#48-12 (Continued)

Fig. 3

Photo (1950)
od Stand of Tall Oat
ass, Tall Fescue and
ding grass.
controlled deer grazing.

Fig. 4

Photo (1950)
Enclosure, showing growth
in protected spot.

UPPER LAKE DISTRICT
(Deer Creek)

GLADE EXTENSION

1948 Project #48-19

Fig. 1

Photo - 1948
Discing chamise on edge of glade.
2-3 foot - Laughlin soil.
Seeded to rye grass, tall fescue,
orchard grass and Burnett.

UPPER LAKE DISTRICT
(Deer Creek)

GLADE EXTENSION - #48-19 (Continued)

Fig. 2

Photo 1950

Photo 1950
Very few of planted grasses survived.
Area invaded by annual grass from
adjoining glade - chamise sprouting.

UPPER LAKE DISTRICT
(Deer Creek)

1949 Project #49-1

Fig. 1

Photo (1949) Area prior to treatment.

Fig. 2

Photo (1950) Area following year after discing and seeding. Seeded to Rye grass - 1949.

UPPER LAKE DISTRICT
(Deer Creek)

Project #49-1 (Continued)

Fig. 3

Area 1 - 6 inch Maymen soil - poor results.
Area 2 - 2 foot Los Gatos soil. Some rye grass - manzanita, chamise, and scrub oak is sprouting.

UPPER LAKE DISTRICT
(Pitney Ridge)

1949 Project
#49-1

Fig. 1

Photo 1949
Contour discing - seeded to rye grass and orchard grass then dragged - some strips fertilized.

Fig. 2

Best results in fertilized strips. Annual grasses are invading. Heavy deer browsing.

UPPER LAKE DISTRICT
(Pitney Ridge)

1949 Project #49-3

Fig. 1

Area prior to treatment. 3 foot Los Gatos soil.
Heavy madrone, scrub live oak, manzanita, chamise.

Fig. 2

Photo 1949. After bulldozing and discing.

UPPER LAKE DISTRICT
(Pitney Ridge)

#49-3 (Continued)

Fig. 3

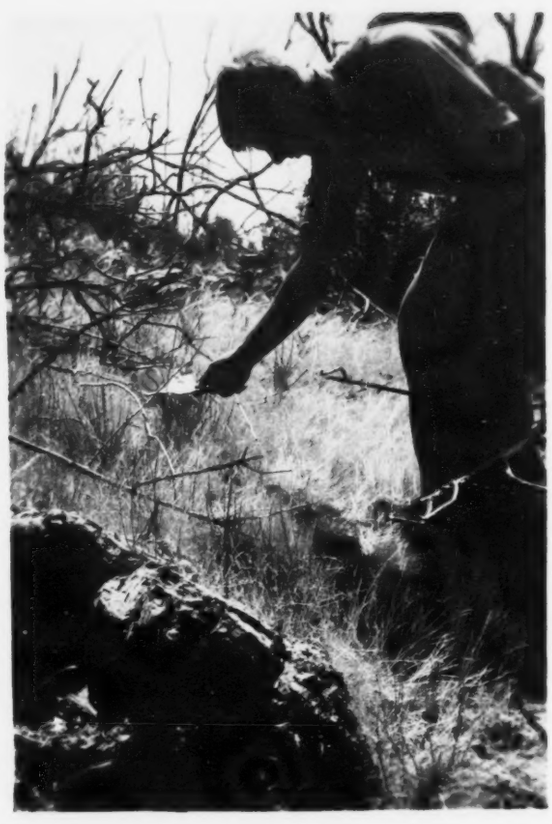
Photo 1949. Seeded with Harding grass, Orchard grass, Timothy, Tall Fescue and Smilo. Part of area fertilized - seed covered on part of area.

Fig. 4

Fair results on fertilized areas only. Annuals are invading from nearby glade. Photo 1951.

UPPER LAKE DISTRICT
(Schuyler Ranch)

Wildfire Area - 1947. Reburned 1950 to kill sprouts and brush seedlings.



hoto 1950
tive annual grass; brush
prouts and brush seedlings.

Same area after fire. Some brush seedlings killed. Little effect on brush sprouts. Area to be burned again 1952.

UPPER LAKE DISTRICT
(Middle Creek)

Fig. 1

Photo fall 1950. Non-sprouting manzanita. Invasion of Oak-Grass Type after 1946 wildfire.

Fig. 2

Same area after reburn. Very few seedlings consumed by fire. Some heat kill in 1, 2 & 3 year old seedlings. Plan to reburn 1952.

STONYFORD DISTRICT
(Elephant Hill)

Aircraft seeding of wildfire area. Burned and seeded to Rye grass - 1949.

Fig. 1

Photo Fall 1951. Poor results first year. Good stand on better soils in 1951. Brush sprouting - some seedlings.

Fig. 2

A good stand of Rye grass. Many brush sprouts and seedlings. Photo 1951.

STONYFORD DISTRICT
(Elephant Hill)

Elephant Hill (Continued)

Fig. 3

Photo Fall 1951. Reburn to kill sprouts and brush seedling. Results will be observed this spring.

Fig. 4

Photo Fall 1951. Poor reburn in thinner grass stands.

FIGURE 1.-- PRODUCTIVITY RATINGS OF SOILS FOR GRASS AND TIMBER
MENDOCINO COUNTY

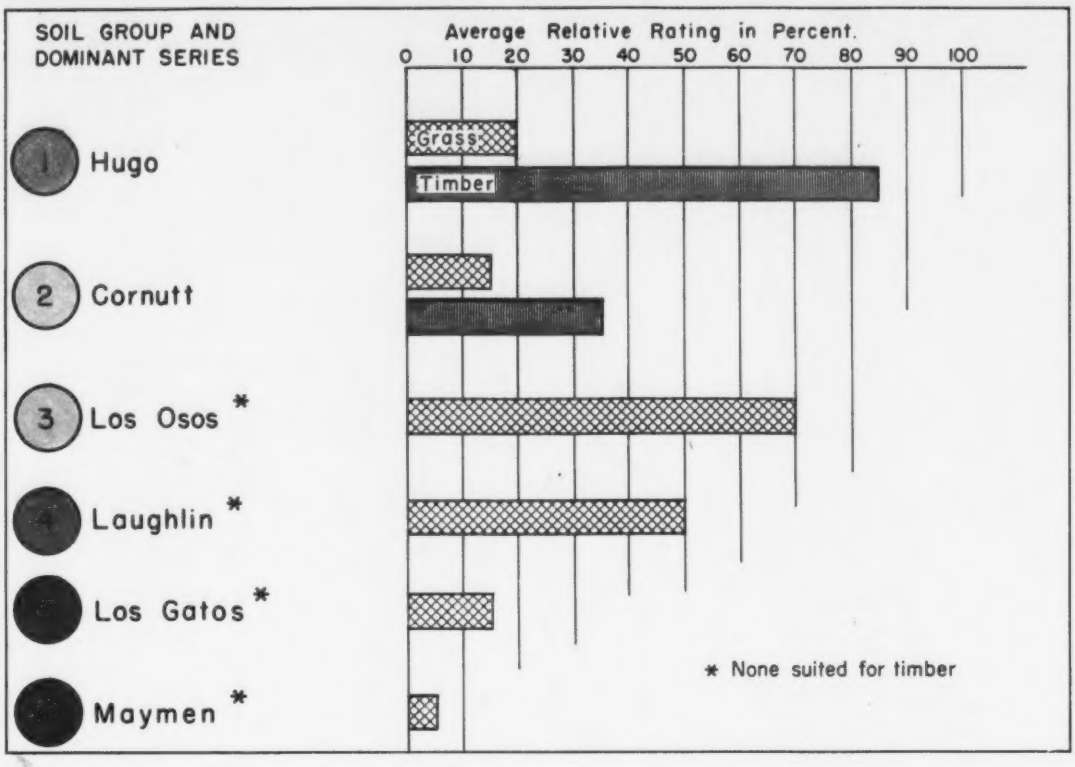
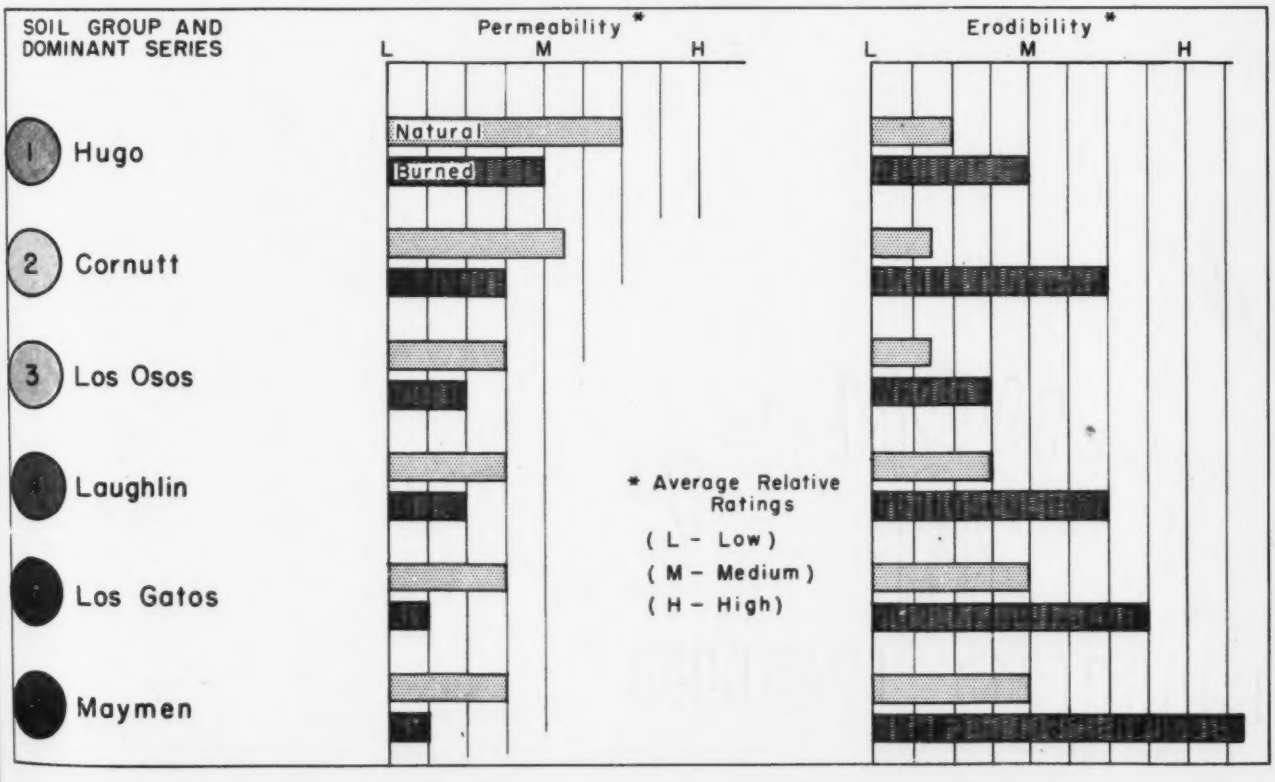
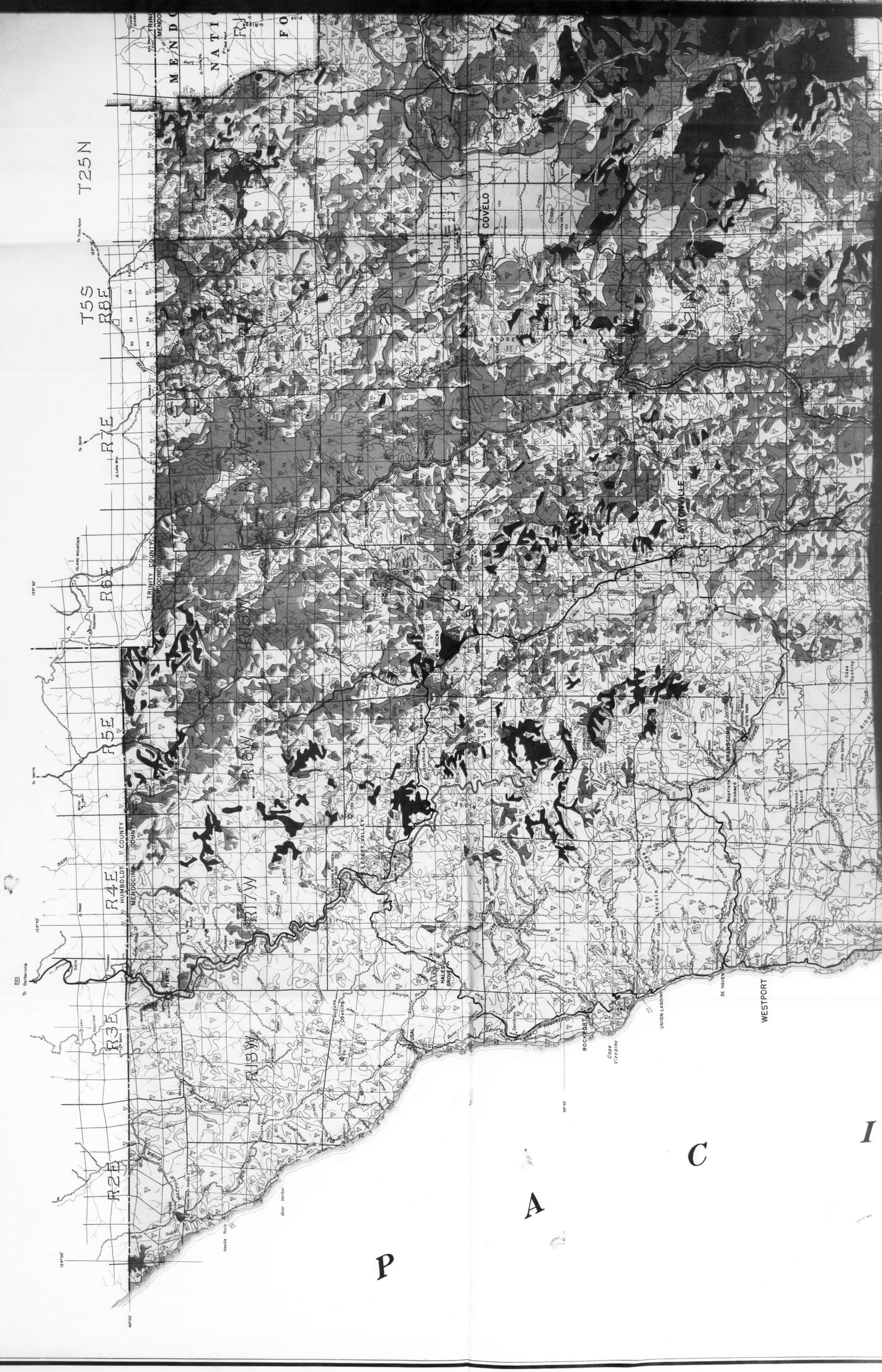


FIGURE 2.-- HYDROLOGIC RATING OF SOILS UNDER NATURAL AND BURNED CONDITIONS
MENDOCINO COUNTY

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R4E R5W
R3E R4W
R2E R3W
MENDOCINO COUNTY
TRINITY COUNTY
HUMBOLDT COUNTY
COVELO
LAYTONVILLE
ROUND VALLEY
HALES GROVE
USAL
ROCKPORT
WESTPORT
DE HAVEN
UNION LANDING
Cape Vizcaino
Bear Harbor
Needle Rock
Bridges Creek
Dugans Opening
Lincoln Creek
Rosemary Creek
Dumbarton Point
Sequoia Park
Redwood Creek
Eel River
Eel River Ridge
Bald Hills Ridge
Kekawaka Ridge
Sinkyone Wilderness State Park
Usal Redwoods
Usal Creek
Usal Ridge
Usal Road
Usal Beach
Usal Campground
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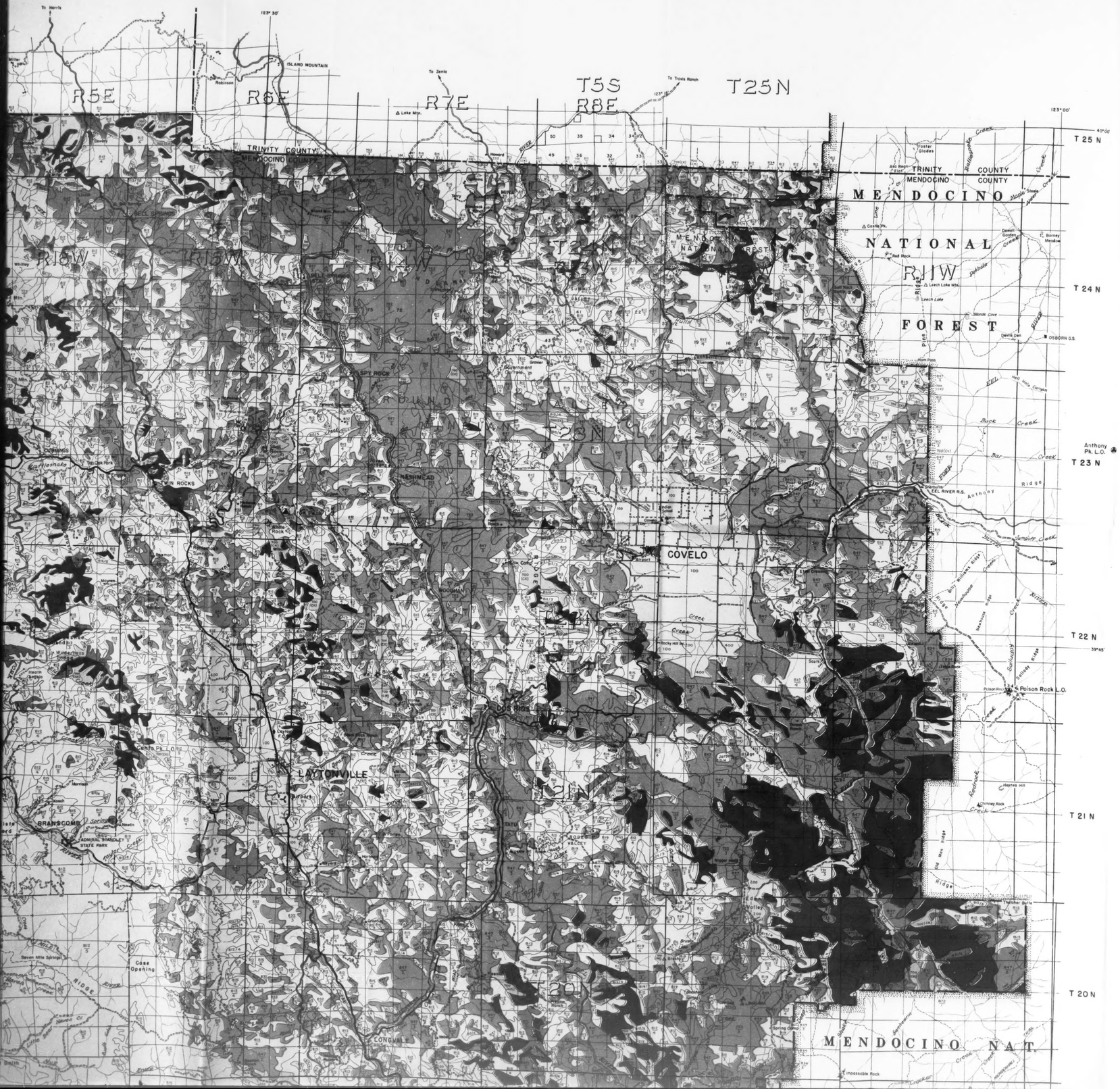
Usal Prairie
Usal Gulch
Usal Creek Trail
Usal Creek Campground
Usal Creek Bridge
Usal Creek Road



STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY

IN COOPERATION WITH

U. S. DEPARTMENT OF AGRICULTURE—FOREST SERVICE
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
DIVISION OF ECONOMICS—FOREST SURVEY

UPLAND SOILS
OF
MENDOCINO COUNTY

(EXCLUSIVE OF NATIONAL FOREST AREAS)

1951

0 1 5 10

Scale in Miles

This soil map is compiled from more detailed 2-inch to the mile scale quadrangle sheets published by the Forest Service as Vegetation-Soil maps.[1] No areas smaller than 40 acres have been shown on this generalized map.

The collection of soils data and the preparation of this map were made under the direction of A. E. Wieslander with technical guidance from R. Earl Storie, Soil Technologist, University of California, and R. A. Gardner, Senior Soil Correlator, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture. K. E. Bradshaw, assisted by K. E. Nelson, supervised the field work, which was done by K. A. Cuff, R. H. Neuns, K. E. Nelson, P. J. Zinke, J. C. Gilman, G. W. Tourtillott, M. Swensen, and W. P. Hoffman. L. H. Smith and P. J. Zinke generalized the data for this map. The compilation and preparation for publication of the map was directed by R. M. Miller. Drafting was done by A. O. Desch, M. M. Cushman, and P. R. Haskey.

[1] The detailed sheets showing both vegetation and soil information are based on aerial photo study and field surveys conducted for the State Division of Forestry in 1947-1950 by the California Forest and Range Experiment Station, Forest Service, United States Department of Agriculture. (The Experiment Station is maintained at Berkeley in cooperation with the University of California.) The detailed map sheets show areas of significantly different soils to a minimum of 10 acres and relatively similar soils to a minimum of 40 acres.

LEGEND

LANDS CLASSIFIED AS TO SOIL SERIES

Soil Series designated by numerator of fraction: ——→ 712
Soil Depth Class designated by denominator of fraction: ——→ 4

Symbol	Depth Class	Depth, Feet
1	Very shallow	Generally less than 1
2	Shallow	From 1 to 2
3	Medium	From 2 to 3
4	Deep	From 3 to 4
5	Very Deep	More than 4

Eroded Phase designated by letter e in denominator of fraction: $\frac{915}{1e}$

Soils normally associated with commercial conifer forest types; rated generally as high and intermediate sites for conifer timber, and low and intermediate for grass.

Symbol	Series Name	Depth Class	Symbol	Series Name	Depth Class
712	Butte	4	818	Usal	3, 4, 5
723	Comptche	3, 4, 5	819	Tatu	3, 4, 5
812	Hugo	3, 4, 5	915	Mendocino	3, 4, 5
814	Melbourne	4, 5	916	Caspar	3, 4, 5
815	Josephine	3, 4, 5	920	Empire	4, 5
816	Sites	3, 4, 5			

Soils normally associated with conifer forest types; rated generally as low and noncommercial sites for conifer timber, and very low for grass.

612	Noyo	2, 3	726	Dubakella	2, 3, 4
725	Cornutt	2, 3, 4			

Soils normally associated with grass types; rated generally as high sites for grass, and unsuited for conifer timber.

731	Climax	2, 3	835	Kneeland	2, 3
832	Los Osos	2, 3, 4	*93X		4

Soils normally associated with oak-grass, grass, and oak types; rated generally as intermediate sites for grass, and unsuited for conifer timber. (Montara series and Laughlin, eroded phase, rated low for grass.)

732	Montara	1, 2	847	Laughlin (eroded phase)	1e
748	Sobrante	2, 3			
752	Yorkville	2, 3	849	Tyson	3
834	Hulls	2, 3	850	Sutherlin	3
847	Laughlin	2, 3, 4	*86X		3

Soils normally associated with chaparral and noncommercial conifer forest types; rated generally as low sites for grass, and unsuited for conifer timber.

871	Los Gatos	1, 2, 3	915	Mendocino (eroded phase)	1e, 2e
877	Cahto	1, 2, 3			

Soils normally associated with chaparral and noncommercial conifer forest types; rated generally as very low for grass, and unsuited for conifer timber.

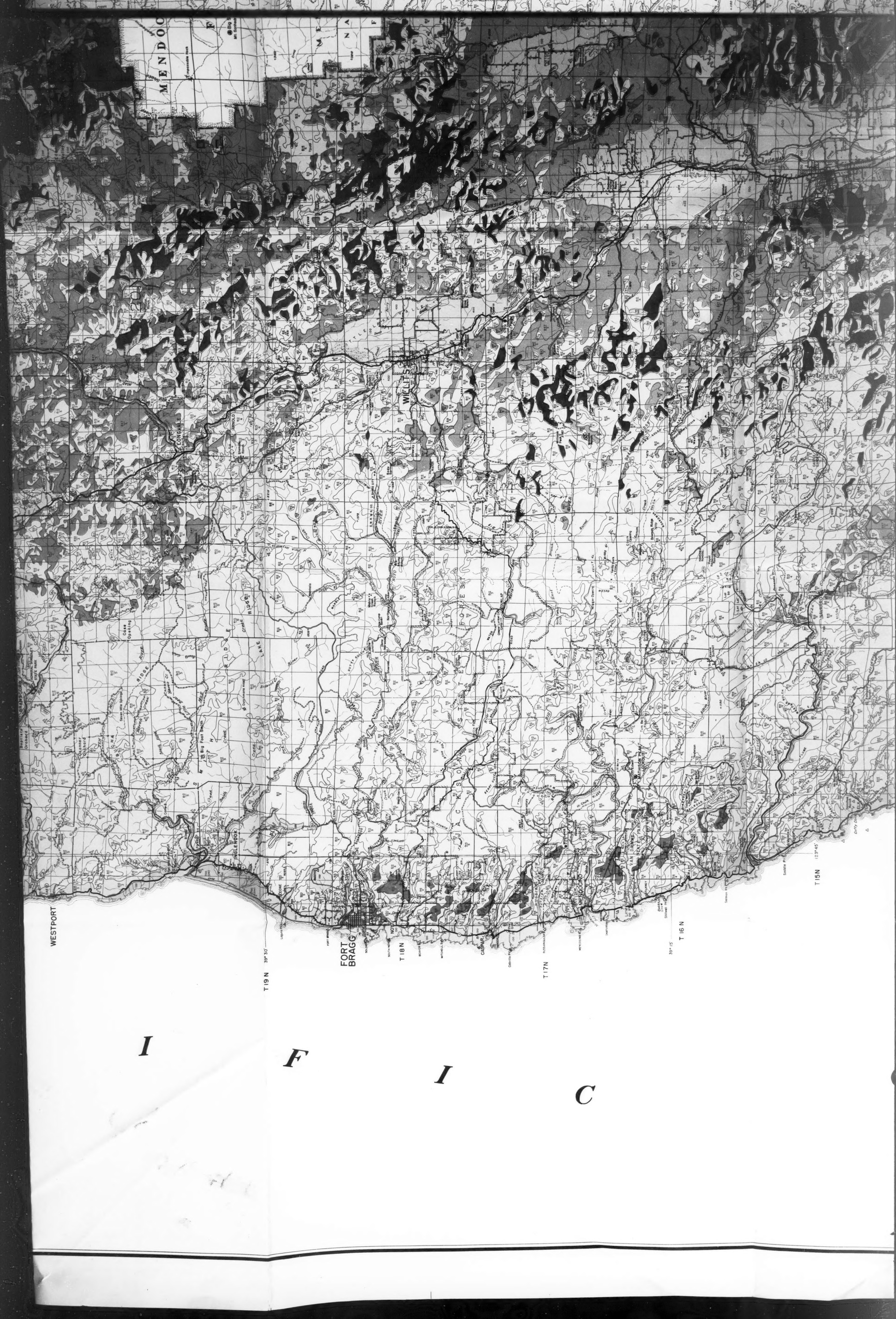
512	Blacklock	1, 2	872	Maymen	1, 2
771	Henneke	1, 2	876	Anchor Bay	1
778	Huse	1, 2	879	Gualala	1, 2

LANDS NOT CLASSIFIED AS TO SOIL SERIES

Kind of land designated by "hundred" number, like 200.

Unclassified soils generally suited for cultivated crops or intensive pasture use.

Symbol	Kind of Land
100	Cultivated, intensively pastured, and urban and industrial areas
200	Bottom lands.
400	Terraces and benchlands.


MENDOCINO
RUSSIAN RIVER
WILLITS
COVELO
LAYTONVILLE
RIDGE
LAKE
Cobb Mountain
Big Foot Smith
HOPLAND
HEALDSBURG
HALEBROOK
WESTPORT
FORT BRAGG
NORTH HIGHLANDS
MENDOCINO
JACKSON STATE FOREST
JUG HANDLE STATE RESERVE
VAN DUZEN
MATTOLE
T19 N
T18 N
T17N
T 16 N
T15N
39° 30'
39° 15'
123° 45'

816	Sites	3, 4, 5			

Soils normally associated with conifer forest types; rated generally as low and noncommercial sites for conifer timber, and very low for grass.

612	Noyo	2, 3	726	Dubakella	2, 3, 4
725	Cornutt	2, 3, 4			

Soils normally associated with grass types; rated generally as high sites for grass, and unsuited for conifer timber.

731	Climax	2, 3	835	Kneeland	2, 3
832	Los Osos	2, 3, 4	*93X		4

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778	Huse	1, 2	879	Gualala	1, 2

LANDS NOT CLASSIFIED AS TO SOIL SERIES

Kind of land designated by "hundred" number, like 200.

Unclassified soils generally suited for cultivated crops or intensive pasture use.

Symbol	Kind of Land
100	Cultivated, intensively pastured, and urban and industrial areas
200	Bottom lands.
400	Terraces and benchlands.

Miscellaneous land types generally unsuited for timber, grass, or cultivated crops. Kind of parent rock and kind of land type designated by pair of letters in parenthesis following the number 700.

700 (BK), (CK), (CM), (CR), (CT), (CW), (DK), (DM), (DR), (DW).

Symbol	Kind of Parent Rock	Symbol	Land Type
B	Basic igneous	K	Colluvial land
C	Sedimentary	M	Marsh
D	Mixed	R	Rock land and Rock outcrop
		T	Talus (rubble land)
		W	Riverwash, Beaches, and Dune Land

* Occasional areas of upland soils which are distinctly different from established soil series, but of very limited extent, are symbolized by a letter replacing the third digit in the numerator of the fraction.

Soils compiled on State Division of Forestry base maps of Mendocino County, 1950 revision.
Polyconic Projection
Original Scale 1:62,500
North American Datum 1927

Additional copies of this map may be purchased from PRINTING DIVISION (DOCUMENTS SECTION), 11th and O Streets, Sacramento 14, California. Price $1.00, including tax.

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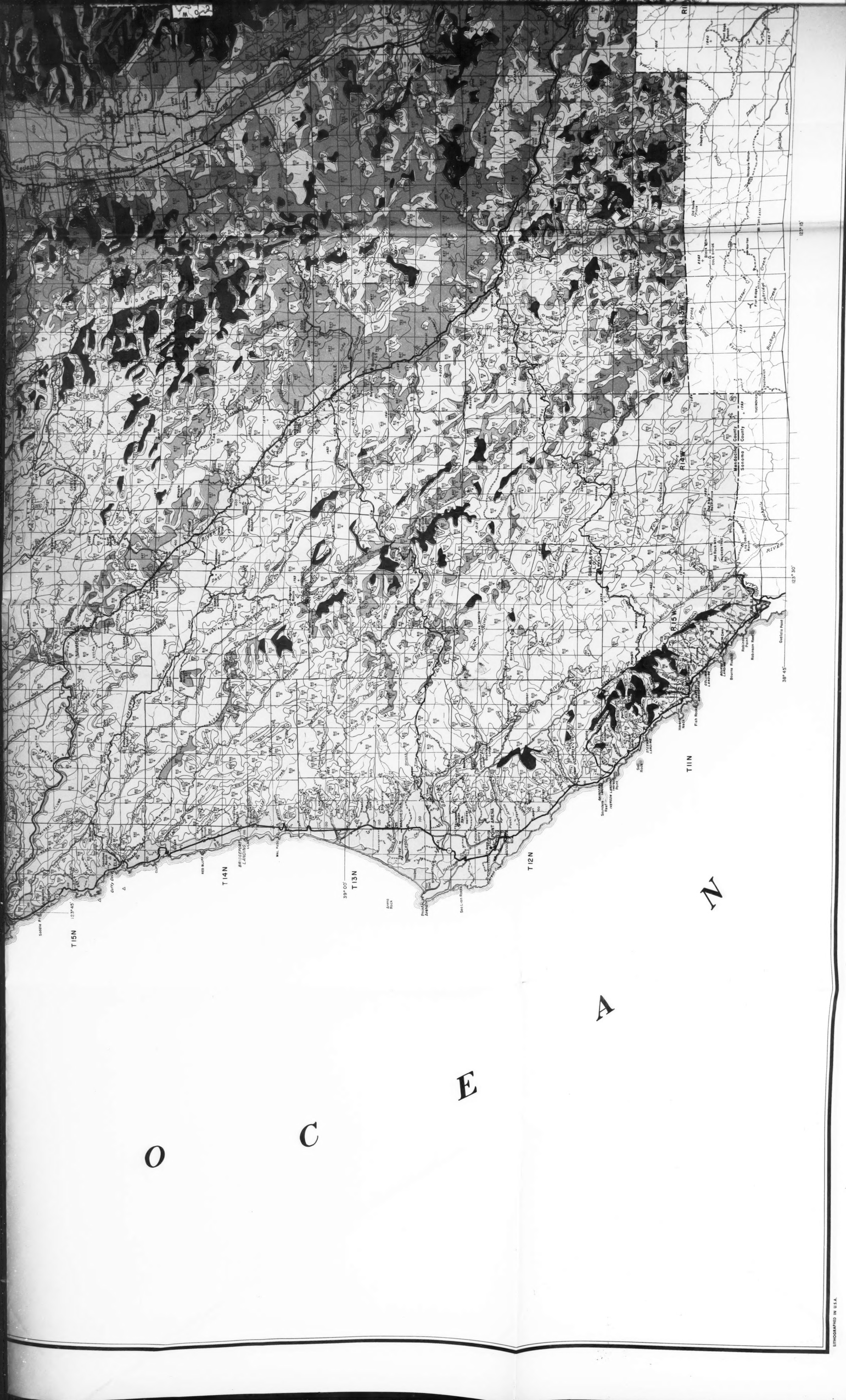
39° 15'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39°00'
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Mendocino County
Sonoma County
OCEAN
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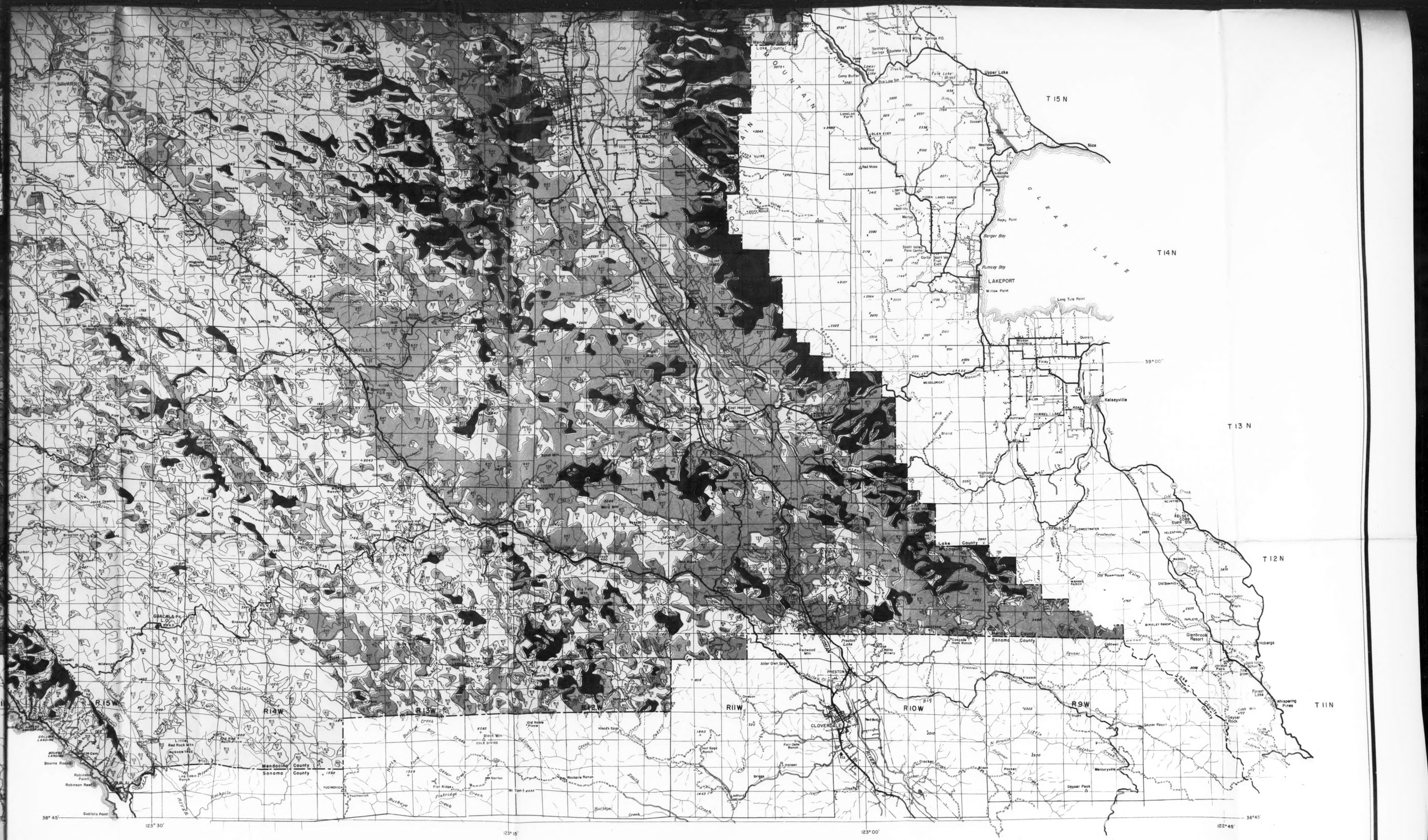
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R 9 W
LAKEPORT
CLOVERDALE
Upper Lake
Nice
Kelseyville
PRESTON
Mendocino County
Sonoma County
Lake County
Clear Lake
Russian River
Eel River
Gualala River
Big River
Navarro River
Noyo River
Pacific Ocean
Point Arena
Gualala Point
Robinson Point
Bourns Landing
Berger Bay
Rumsey Bay
Willow Point
Long Tule Point
Rocky Point
Geyser Peak
Geyser Resort
Glenbrook Resort
Whispering Pines
Forest Lake
Hobergs
Harrington Falls
Mercuryville
Pocket
Cobb Mtn
Mt Tom
Big Foot Mtn
Red Mtn
Black Mtn
Redwood Mtn
Sonoma Mtns
Mayacmas Mts
Coast Ridge
Yolla Bolly Mtns
Lower Lake
Middletown
Hopland
Ukiah
Willits
Laytonville
Fort Bragg
Cloverdale
Healdsburg
Guerneville
Jenner
Sea Ranch
Annapolis
Stewarts Point
Anderson Ranch
Hathaway Ranch
Whipple Ridge
Jacks Crossing
Wildcat Ridge
Old Corral Ridge
Old Rock Pile Ridge
Old Noble Place
Old Powerhouse
Old Sawmill
Old Orchard Ridge
Old Ranch
Old Stage Road
Old Cazadero Road
Old Coast Road
Old Logging Road
Old Mill Creek Road
Old Mill Valley Ranch
Old Stage Ranch
Old Stage Road
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